



**CONTROL DATA®
FLEXIBLE DISK DRIVE
MODEL 9406**

**GENERAL DESCRIPTION
OPERATION
INSTALLATION AND CHECKOUT
THEORY OF OPERATION
DIAGRAMS
MAINTENANCE
MAINTENANCE AIDS
PARTS DATA
WIRE LISTS**

MAGNETIC PERIPHERALS INC.

 a subsidiary of
CONTROL DATA CORPORATION

HARDWARE MAINTENANCE MANUAL



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R E V I S I O N R E C O R D															
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AA	80 SW DEC 11	ii, iii, v	T	T	V	T	Y	Z	B	K	T				PL 20497
AB	81 SW MAR 4	ii	T	T	V	T	Y	Z	B	L	T				PL 20530
AC	81 SW APR 24	ii, iv, vi, viii	T	T	V	T	Y	AC	B	L	T				PL 20546
AD	81 SW MAY 20	ii	T	T	V	T	AD	AC	B	L	T				PL 20560
AE	81 SW JUL 14	ii	T	T	V	T	AE	AC	B	L	T				PL 20597
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PREFACE

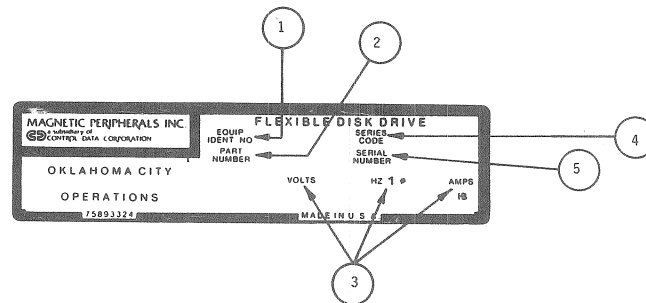
This manual provides the information needed to install, operate and maintain the Control Data Corporation Flexible Disk Drive (FDD) and is intended to support customer engineers who require detailed information about the Flexible Disk Drive's operation.

The total content of the manual is comprised of two publications, each having a unique publication number, and is contained in one volume. The Manual's publication number (77614903) is that of the front matter, sections one through seven, and section nine. This number should be used when making reference to the Flexible Disk Drive Hardware Reference Maintenance Manual.

This manual applies to several models of the FDD. A configurator sheet is provided on the following page which describes each FDD configuration that this manual will support. Refer to the equipment nameplate located on the right hand side of the unit (as viewed from the front) to determine the appropriate Hardware Product Configurator (HPC) and Equipment number. Then use the Configurator sheet as a starting point to establish the maintenance level for the device. Section VIII Parts Data is identified by the unique Publication number 75888344.

EMI NOTICE

NOTICE: This equipment has been designed as a component to high standards of design and construction. The product, however, must depend on receiving adequate power and environment from its host equipment in order to obtain optimum operation and to comply with applicable industry and governmental regulations. Special attention must be given by the host manufacturers in the areas of safety, power distribution, grounding, shielding, audible noise control, and temperature regulation of the device to insure specified performance and compliance with all applicable regulations. This equipment is a component supplied without its final enclosure and therefore is not subject to standards imposed by FCC Rules for Electro-Magnetic Interference (EMI). Federal Docket 20780/FCC 80-148 Part 15.



- 1 EQUIPMENT IDENTIFICATION NO./ HARDWARE PRODUCT CONFIGURATOR (HPC)
- 2 HARDWARE PRODUCT CONFIGURATOR (HPC)
- 3 AC POWER REQUIRED (ON UNITS LABELED 50/60 HZ, CHECK CONFIGURATION OF SPINDLE-MOTOR PULLEY FOR FREQUENCY).
- 4 EQUIPMENT STATUS NUMBER
- 5 UNIT SERIAL NUMBER

Z204a

POWER REQ.	VDC	+5 & +24 AT J4									
	VDC	+5 & +24 AT I/O J1									
	VAC	240, 1Ø									
	VAC	220, 1Ø									
	VAC	120 1Ø									
		100 1Ø									
CIRCUIT BD. CONFIG. (See Table 5-1)											
DAISY-CHAIN INTERFACE											
STANDARD INTERFACE											
HPC NO.		EQUIP NO.									
77618000			X	300				X			X
77618001			X	300					X		X
77618002			X	350				X			X
77618003		X		400							
77618004		X		400					X		
77618005		X		400						X	
77618015			X	930						X	
77618016			X	930					X		X
77618018			X	350					X		X
77618019			X	2400					X		X
77618028		X	X	400				X			X
77618029			X	2400					X		X
77618033			X	930				X			X

XX184a

TABLE OF CONTENTS

EMI NOTICE	iii
GENERAL DESCRIPTION	
1.1	INTRODUCTION 1-1
1.2	PURPOSE AND USE OF EQUIPMENT 1-1
1.3	PRODUCT DESCRIPTION 1-1
1.3.1	Physical Description 1-1
1.3.2	Electrical Description 1-2
1.3.3	Performance Characteristics 1-2
OPERATION	
2.1	INTRODUCTION 2-1
2.2	OPERATING INSTRUCTIONS 2-1
2.2.1	Flexible-Diskette Loading 2-1
2.3	ERROR RECOVERY 2-1
2.3.1	Seek Error 2-1
2.3.2	Write Error 2-1
2.3.3	Head Error 2-2
2.4	DISKETTE HANDLING RECOMMENDATIONS 2-2
INSTALLATION AND CHECKOUT	
3.1	INTRODUCTION 3-1
3.2	UNPACKING 3-1
3.3	INSTALLATION 3-1
3.4	CABLING AND CONNECTIONS 3-1
3.4.1	Input-Output Cable 3-1
3.4.2	DC Power Connection 3-2
3.4.3	AC Power Connection 3-2
3.5	ENVIRONMENT 3-2
3.6	INITIAL CHECKOUT 3-2
3.6.1	Operating Frequency 3-3
THEORY OF OPERATION	
4.1	INTRODUCTION 4-1
4.2	GENERAL DESCRIPTION 4-1
4.3	FUNCTIONAL DESCRIPTION 4-3
4.3.1	Control Logic 4-3
4.3.2	Write and Fault Logic 4-6
4.3.3	Read Logic 4-6
4.3.4	Diskette Drive 4-7
4.3.5	Read/Write Heads 4-7
4.4	CONTROL AND DATA LINE CHARACTERISTICS 4-7
4.4.1	Logic Levels 4-7
4.4.2	Transmitter Characteristics 4-7
4.4.3	Line-Receiver Characteristics 4-7
4.4.4	Control and Data-Line Functions 4-8

DIAGRAMS

5.1	INTRODUCTION	5-1
-----	--------------------	-----

MAINTENANCE

6.1	INTRODUCTION	6-1
6.2	MAINTENANCE TOOLS	6-1
6.3	TROUBLESHOOTING	6-1
6.3.1	DC Voltage and Signal Check	6-2
6.4	ADJUSTMENT PROCEDURES	6-4
6.4.1	Write-Splice Check and Adjustment	6-4
6.4.2	Actuator Alignment	6-5.1
6.4.3	Clamshell-Closed Switch Adjustment	6-7
6.4.4	Track 00 Optical Sensor Adjustment	6-7
6.4.5	Diskette Ejector	6-8
6.4.6	Diskette-Load-Pad Adjustment	6-8
6.4.7	Head-Unload Clearance	6-9
6.4.8	Band Alignment	6-9
6.4.9	Azimuth Adjustment	6-10
6.5	REMOVAL AND REPLACEMENT PROCEDURES	6-10
6.5.1	Printed-Circuit Board (PWA)	6-11
6.5.2	Head Replacement	6-11
6.5.3	Drive-Motor Assembly	6-14
6.5.4	Actuator Replacement	6-14
6.6	FREQUENCY CONVERSION	6-14
6.6.1	Operating-Frequencies Conversion Procedure	6-14

MAINTENANCE AIDS

7.1	INTRODUCTION	7-1
7.2	PHYSICAL DESCRIPTION (Logic)	7-1
7.3	USE OF RELATIVE-LEVEL INDICATORS	7-1
7.4	INTEGRATED CIRCUITS	7-1

PARTS DATA (75888344)

8.1	INTRODUCTION	8-1
8.2	ILLUSTRATIONS	8-1
8.3	PARTS LIST	8-1
8.4	PRODUCT CONFIGURATIONS	8-1
8.4.1	Hardware Product Configurator (HPC)	8-1
8.5	REPLACEMENT PARTS	8-2
8.5.1	Spare Parts	8-2
8.6	PARTS LIST INSTRUCTIONS	8-13
8.6.1	Illustration Parts Lists	8-13
8.6.2	Top-Down-Assembly/Component-Parts List	8-13
8.6.3	Cross-Reference Index	8-13
8.6.4	Sheet-Number Referencing	8-13

WIRE LISTS

9.1	INTRODUCTION	9-1
9.2	UPPER-HARNESS ASSEMBLY	9-1
9.3	LOWER-HARNESS ASSEMBLY	9-1
9.4	STEPPER MOTOR	9-1
9.5	DISKETTE IN PLACE	9-2
9.6	DOOR-LOCK-SOLENOID ACTIVITY LED	9-2
9.7	HEAD ASSEMBLIES	9-2

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
2-1	Configurator Sheet Diskette Installation	iv 2-2
3-1	AC Cable Assembly	3-3
4-1	Functional Block Diagram	4-2
5-1	Timing	5-2
5-2	Schematics	5-4
5-3	Assembly and Parts List	5-11
6-1	-Head-Load and Door-Close Switch	6-2
6-2	Differential-Read Signal for Entire Track	6-3
6-3	Differential-Read Signal for Portion of Outer Track	6-3
6-4	Write Data, Write F/F Output, and Head Write Voltage for Outer Track	6-3
6-5a	Write-Splice Timing	6-5
6-5b	Single- and Two-Sided-Sensor Adjustment Means	6-5
6-6	Head-Alignment Amplitude	6-6
6-7	Track 00 Optical-Sensor Output	6-7
6-8	Ejector, Latch and Latch Block	6-8
6-9	Load-Pad Adjustment	6-9
6-10	Head-Unload Clearance	6-9
6-10.1	Azimuth Patterns	6-10.1
6-11	Positioning and Head-Load Mechanism, Clamshell Cover Raised	6-12
6-12	Head-Load Carriage and Stepper-Motor Details	6-13
6-13	Drive-Pulley Reversal	6-15/6-16
7-1	Inversion Conventions	7-1
7-2	Integrated Circuit	7-2
7-3	Schematic Symbols	7-2
IPC	Section VIII (Parts)	8-1

LIST OF TABLES

TABLE	TITLE	PAGE
4-1	Phase Sequence of Stepper Motor	4-4
4-2	Input/Output Lines	4-8
5-1	PWA Configurator	5-1
6-1	Test Points	6-2
6-2	Write-Splice Adjustment	6-5

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Flexible-Disk Drive (FDD) is a compact, portable, random-access, data-storage device that interfaces with a central processor via a control unit. Input/Output data and control signals are transmitted by means of an I/O cable.

1.2 PURPOSE AND USE OF EQUIPMENT

Data, in the form of magnetized bits, is written on, or read from the tracks of a rotating diskette. The FDD uses a single, flexible, removable diskette enclosed in a sealed jacket. The unit is capable of hard-sector or soft-sector operation.

1.3 PRODUCT DESCRIPTION

The major FDD components are the spindle, disk drive motor, read/write heads, stepping motor, track-indexing devices and printed-circuit board.

The options include Write Protect, Sector Separation, Unit Select, Ready, Door Unlock, Write Fault, and Hour Meter.

Standard Models Versus Daisy-Chain Models - Throughout this manual certain features and operation of the Flexible-Disk Drive are described in terms of the manner in which the FDD is designed to be connected to its controller, either standard or daisy chain.

Standard models are designed to be connected to their associated controller in star fashion wherein each FDD unit has its own complete umbilical cable connection to the controller, with no interconnection between FDD units. Standard FDD model units are always in a ready state for reading or writing operation after initial preparation and turn on.

Daisy-chain models are designed so that one to four FDD units may be connected serially to a common controller. The controller continuously monitors the operational readiness of each FDD in its chain and commands and controls the reading and writing operation of any selected FDD unit in its chain.

1.3.1 PHYSICAL DESCRIPTION

The physical dimensions for the equipment are as follows:

Height	4.97 inches (126.2 mm)
Width	8.78 inches (223.0 mm)
Depth	14.24 inches (361.7 mm)
Weight	12 lbs. (5.44 kg).

1.3.2 ELECTRICAL DESCRIPTION

The electrical specifications for the equipment are as follows:

- DC Power Source (Supplied by Host Equipment)
 - +24 volts (+10%) @ 0.1 A (average when deselected)
1.4 A (average when seeking)
 - + 5 volts (+ 5%) @ 1.1 A (average current quiescent state)
- AC Power Source - Refer to the FDD configurator or FDD nameplate to determine AC power requirements.

1.3.3 PERFORMANCE CHARACTERISTICS

The equipment specifications for the FDD are as follows:

- ACCESSING TIME

Maximum Access Time	248 ms
Maximum One-Track Access Time	23 ms
Average Access Time	96 ms

- RECORDING

Mode			
Density (nominal)	<u>Double Frequency</u>	<u>MFM</u>	<u>Track</u>
Head 0	1836 BPI (72 BPmm)	3672 BPI (145 BPmm)	Outer
	3268 BPI (129 BPmm)	6536 BPI (257 BPmm)	Inner
Head 1	1879 BPI (74 BPmm)	3758 BPI (148 BPmm)	Outer
	3408 BPI (134 BPmm)	6816 BPI (268 BPmm)	Inner
Data Transfer Rate	249, 984 bits/sec	499, 968 bits/sec	
Bits/Byte	8	8	
Bits/Track	41, 664	83, 328	
Tracks/Surface	77	77	
Sectors	Format Determined	Format Determined	

- DATA CAPACITY

Bytes/Track	5,208	10,416
Bits/Track	41,664	83,328
Bits/Surface	3,208,128	6,416,256

- FLEXIBLE DISKETTE
(Optional)

Diskette Dimensions

Useable Diskette Recording
Surfaces

Diskette Surface Diameter
Recording Radii (Nominal)

Head 0

Head 1

Diskette Surface Coating
Diskette Velocity

CDC 421 Single-Sided, Single-Density
CDC 423 Single-Sided, Double-Density

CDC 425 Double-Sided, Double-Density
8 x 8 inches (203.2 x 203.2 mm)
(including jacket)

2

7.88 in. (200.1 mm)

Track 76 2.0290 in. (51.5 mm) Inner

Track 00 3.6123 in. (91.8 mm) Outer

Track 76 1.9457 in. (49.4 mm) Inner

Track 00 3.5290 in. (89.6 mm) Outer

Magnetic Oxide

360 r/min

- READ/WRITE HEADS

Heads/Unit

2

Track Width

0.013 in. (0.33 mm)

Track Spacing

0.02083 in. (0.529 mm)

Erase to Read/Write Gap

0.036 in. (0.914 mm).

OPERATION

2.1 INTRODUCTION

The FDD is under direct control of the input/output and power sources. No special start-up procedure is required. Operation is fully automatic and requires no operator intervention during normal operation.

2.2 OPERATING INSTRUCTIONS

Verify that power and I/O cables are securely attached before operation.

2.2.1 FLEXIBLE DISKETTE LOADING

- a. Apply AC/DC power to unit.
- b. Open FDD door.
- c. Remove diskette from storage envelope as shown in Figure 2-1.
- d. On units with the Write-Protect option, be sure the Write-Protect slot in the jacket is open, as shown in Figure 2-1, if the diskette is to be write-protected.
- e. If a diskette with a Write-Protect slot is not utilizing the Write Protect, that is, it will be written on, the slot must be covered with a piece of tape which is opaque to infrared.
- f. Carefully slide diskette into FDD, as shown in Figure 2-1, until jacket is solidly against stops and sets the ejector mechanism.
- g. Carefully close unit door. Ensure that jacket is properly seated, spindle has engaged diskette, and door is closed and latched.
- h. Protect the empty envelope from liquids, dust, and metallic materials.

2.2.2 FLEXIBLE DISKETTE REMOVAL

- a. Open FDD door to stop diskette rotation and disengage spindle.
- b. Remove diskette from FDD and put it in its storage envelope.
- c. Close FDD door.

2.3 ERROR RECOVERY

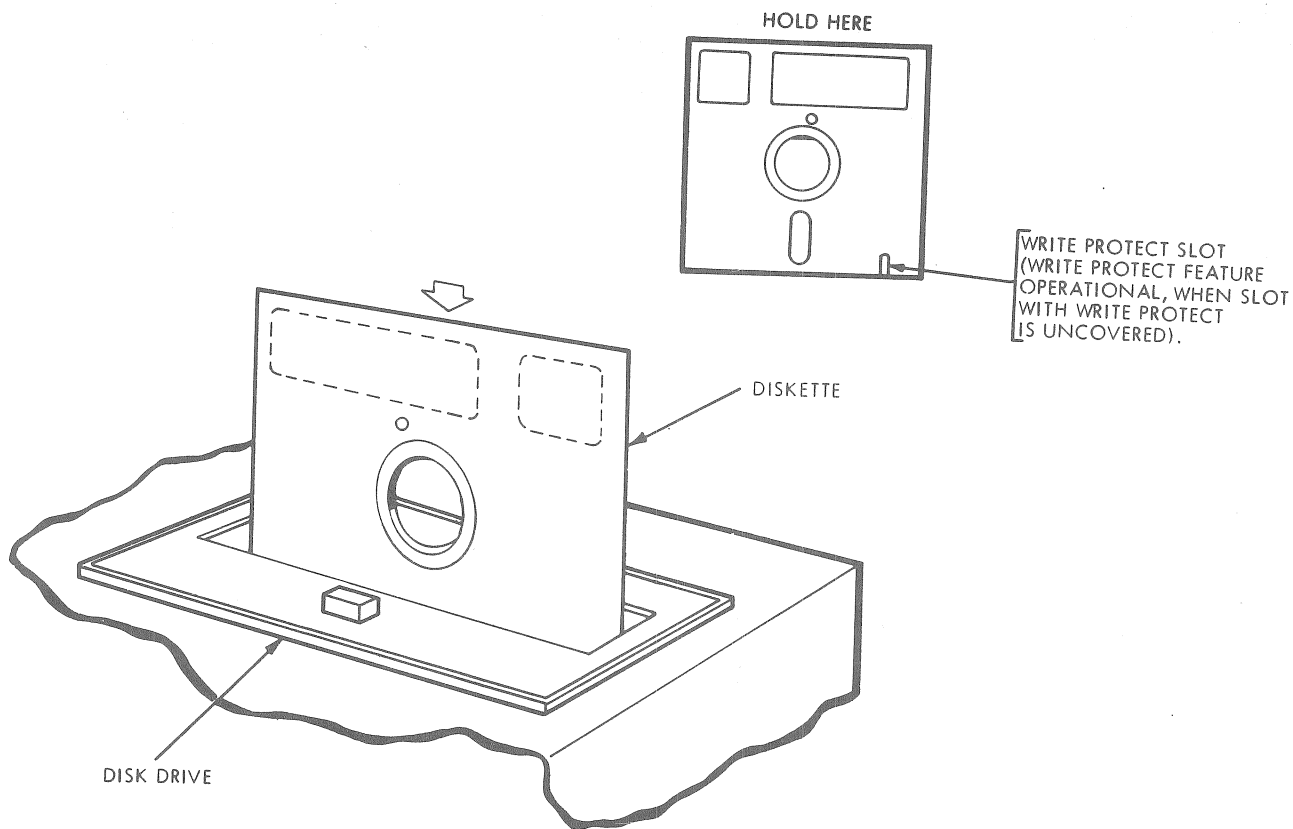
The following paragraphs give information needed to recover from possible errors in equipment operation.

2.3.1 SEEK ERROR

Seek errors will rarely occur unless the stepping rate is exceeded. In the event of a seek error, recalibration of track location can be achieved by repetitive Step Out commands until a Track 00 signal is received.

2.3.2 WRITE ERROR

To guard against degradation from imperfections in the media, no more than four attempts to write a record should be used when read after write errors are encountered. In the event a record cannot be successfully written within four attempts, it is recommended that the sector or track be labeled defective and an alternate sector or track assigned. If more than two defective tracks are encountered, it is recommended that the diskette be replaced.



X260a

Figure 2-1. Diskette Installation

2.3.3 READ ERROR

In the event of a Read error, up to five attempts should be made to recover with re-reads. If after five attempts the data has not been recovered, retract the head to Track 00, reseek to the data track and attempt five additional rereads. Unloading the head when data transfers are not imminent will increase the data reliability and extend the diskette life.

2.4 DISKETTE HANDLING RECOMMENDATIONS

Since the recorded diskette contains vital information, reasonable care should be exercised in its handling. Longer diskette life and trouble free operation will result if the following recommendations are followed.

- a. Do not use a writing device which deposits flakes e.g., lead or grease pencils, when writing on diskette jacket label.

- b. Do not fasten paper clips to diskette jacket edges.
- c. Do not touch diskette surface exposed by jacket slot.
- d. Do not clean diskette in any manner.
- e. Keep diskette away from magnetic fields and from ferromagnetic materials that may be magnetized.
- f. Return diskette to envelope when removed from FDD.
- g. Protect diskette from liquids, dust, and metallic substances at all times.
- h. Do not exceed the following storage environmental conditions:

Temperature:	50° to 125°F (10° to 56.1°C)
Relative Humidity:	8% to 80%
Maximum Wet Bulb:	85°F (29.4°C)

- i. Diskettes should be stored in a box or cabinet when not in use.
- j. Remove diskette before applying or removing power to the FDD.

INSTALLATION AND CHECKOUT

3.1 INTRODUCTION

This section provides the information and procedures necessary to put an FDD into operation.

3.2 UNPACKING

Unpack FDD as follows:

- a. Cut banding and lift top half of styrofoam shell from unit.
- b. Lift unit in polyethylene bag from bottom half of styrofoam shell and remove unit from polyethylene bag.

During unpacking, care must be used so that any tools being used do not inflict damage to the unit. As a unit is unpacked, inspect it for possible shipping damage. All claims for this type of damage should be filed promptly with the carrier involved. If a claim is filed for damages, save the original packing materials.

3.3 INSTALLATION

Install the FDD in the designated location in the host equipment. Remove blank head protective diskette from unit.

3.4 CABLING AND CONNECTIONS

Connect the AC cable, I/O cable, and DC cable if applicable between the FDD and host equipment. Adequate circuit protective devices must be provided by the host equipment to meet applicable safety standards.

3.4.1 INPUT-OUTPUT CABLE

The maximum cable length from connector to connector is 25 feet. The characteristic impedance typically is 120 ohms.

The information relative to the I/O connector (J1) and pin/signal assignments are defined in Table 5-1, Figure 5-2, and Figure 5-3.

On models designed for daisy-chain operation, the terminating resistor pack RM1 (see Figure 5-3) is to be installed in the end FDD (farthest from the controller) ONLY. Terminators in more than one FDD during daisy-chain hookup may result in damage to the controller.

For daisy-chain configurations, switch S1 (S2 if door-unlock option is included) is provided on the circuit board to enable changing the position of the FDD in the daisy chain by switch selection.

3.4.2 DC POWER CONNECTION

DC power (user-supplied) for standard FDD models is transmitted from the controller via the I/O cable through the interface connector (J1) on the printed-circuit board. Daisy-chain FDD models receive DC power (user-supplied) through a power cable which interfaces with its mating connector (J4) on the printed-circuit board. The pin assignments and line functions are shown on sheet 1 of the schematics, Figure 5-2. The mating connector is described in Figure 5-3.

3.4.3 AC POWER CONNECTION

The mating connector cable should consist of stranded wire, 18 AWG minimum with center-pin connection utilized as frame ground. Refer to Figure 3-1 for connector part numbers and attachment.

3.5 ENVIRONMENT

Operating and storage environments of the FDD are as follows:

Operating:	50° to 100°F (10° to 38°C) 12°F (6.6° C) / hr. max. fluctuation 20% to 80% relative humidity (providing there is no condensation)
Non-Operating:	-30° to +150°F (-35° to 65°C) 5% to 95% relative humidity (providing there is no condensation) Max. Wet Bulb 80°F (27°C).

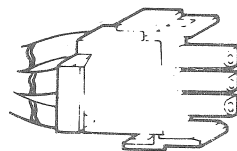
3.6 INITIAL CHECKOUT

This procedure should be used to determine that the FDD is operational. The procedure assumes that the unit is installed and the I/O and power cables are connected.

- a. Apply AC power to unit and visually check that the spindle rotates. NOTE: Assure that the protective disk has been removed before applying power.
- b. Apply DC power to unit.
- c. For daisy-chain:
 1. Close one of the Unit Select switches (dipswitch position, 1, 2, 3, or 4) located on the circuit board.
 2. Close one of the Ready switches (dipswitch position 5, 6, 7, or 8) located on the circuit board.
 3. If the Door Unlock option is installed, close one of the Door Unlock switches (dipswitch position 9, 10, 11, or 12) located on the circuit board.
- d. Insert diskette as described in Section 2.
- e. Apply a head-load-command signal to the unit and close the access door. Check that the head-load solenoid actuates, and the door microswitch is actuated.
- f. Apply a stepping-command signal to the unit and check that the actuator steps the head as commanded.
- g. Remove the command signals and power from the unit.
- h. Remove diskette.

3.6.1 OPERATION FREQUENCY

If the required operating frequency is different than that which the unit is configured, the procedure for converting operating frequencies using the dual-diameter reversible pulley is provided in Section 6, "Frequency Conversion" for applicable models.



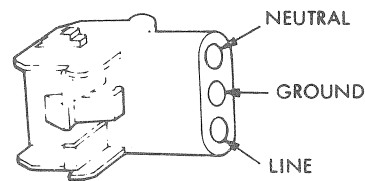
CABLE CONNECTOR
MATING PLUG

PLUG:

AMP PN 1-480700-0
MPI PN 83435302-1

CONTACTS: (SOCKET)

AMP PN 350536-1 (STRIP)
AMP PN 350550-1 (LOOSE)
MPI PN 83435507-5



RECEPTACLE ON
FDD ASSEMBLY

RECEPTICLE:

AMP PN 1-480701-0
MPI PN 83435402-8

CONTACTS: (PIN)

AMP PN 350547-1 (LOOSE)
AMP PN 350218-1 (STRIP)
MPI PN 83435501-8 (STRIP)

X259a

Figure 3-1. AC Cable Assembly

THEORY OF OPERATION

4.1 INTRODUCTION

The basic functions performed by the standard and daisy-chain models of the FDD are: (1) Receive and generate control signals, (2) Position the Read/Write heads on selected tracks, and (3) Write or Read data upon command from the FDD controller. In the case of daisy-chain models, these functions are accomplished upon selection after initial indication to the controller that the FDD is ready to operate and accept commands. The standard models should be regarded as always selected.

The theory of operation for the FDD is divided into two parts. The first part gives a general theory of operation. The second part gives a detailed functional description of all major components both electronic and mechanical and describes all signals exchanged between the FDD and the controller.

4.2 GENERAL DESCRIPTION

The basic function of the FDD is to indicate to the controller when it is ready to operate, and respond to the commands of the controller to: (1) receive and generate control signals; (2) position the Read/Write heads to selected tracks; and (3) write or read data on the diskette when selected. All of the functions described which are options may not apply to your particular FDD model. (Refer to the Preface at the front of the manual.)

Signals received and transmitted by the FDD are shown in Figure 4-1. All signals received by the FDD, except the door-unlock signal are gated with Unit Select so that no stepping, reading or writing can be performed on an unselected FDD. Also, all signals generated within the FDD, except the Ready signal, are gated with Unit Select so that no signals can be transmitted from an unselected FDD.

During the write operation, the selected FDD receives Head Select, Write Enable, Write Data and Low Current (Track 43 or greater) signals. If a Write Fault occurs, it will be transmitted to the controller. During read operation, the selected FDD will receive a Head Load command. The Write Enable line remaining high implies a read operation. Under these condition, the FDD will transmit Composite Read Data signals to the controller. Controller Step and Direction commands are received initiating a track-seek operation on a selected FDD. The FDD transmits Index and Sector pulses as long as it selected. Also, the selected FDD transmits a Track 00 signal to the controller whenever the Read/Write heads are at Track 00.

Positioning of the carriage-mounted Read/Write heads is accomplished by a band-driven stepper motor. Each step command from the user system increments the stepper motor which, in turn, moves the band. The band increments the Read/Write heads one track position for each step command.

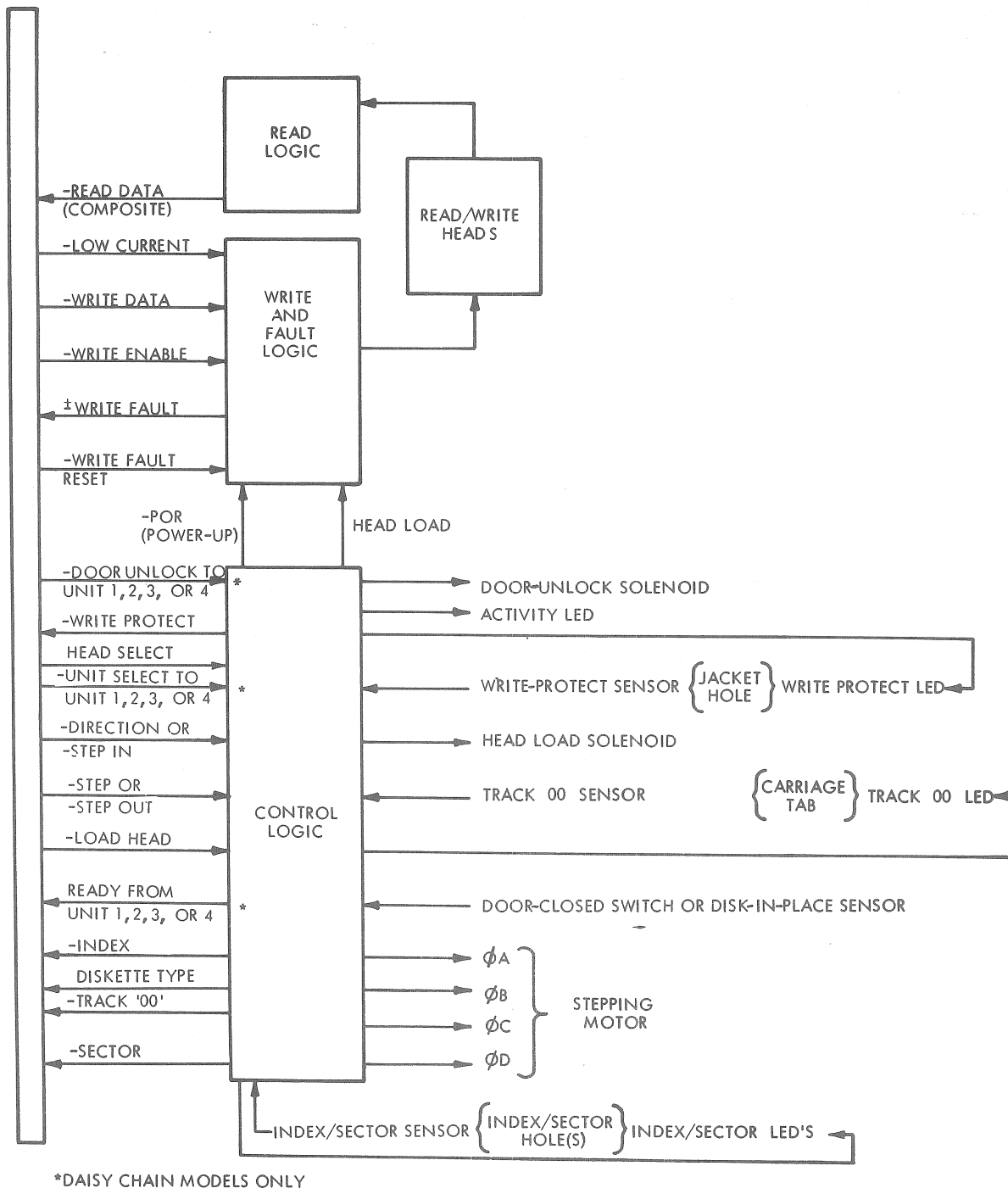


Figure 4-1: Functional Block Diagram

A reading or writing operation begins by placing the Read/Write heads in contact with the diskette with a Head-Load command and at the desired track. To write on the diskette, Write Enable is sent by the controller to condition the write logic. The write current then in the head, reverses polarity synchronous with the low-to-high transitions of the Write-Data pulses from the controller. The current reversals cause magnetic flux reversals on the desired diskette track. Erasure of previously recorded data is simultaneously accomplished during the writing operation in addition to a delayed-tunnel-erase which ensures disk interchangeability.

To read from the diskette, magnetized bits in the format of the pre-recorded data are sensed by the Read/Write heads. This signal is amplified, digitized and transmitted to the user system.

4.3 FUNCTIONAL DESCRIPTION

Refer to Figure 4-1, 5-1, and the Schematic Diagram (Section 5) for the following discussion.

The FDD is divided into the following major functional areas:

- | | |
|--------------------------|--------------------|
| a. Control Logic | f. Read/Write Head |
| b. Write and Fault Logic | g. Index |
| c. Stepper Control | h. Door Unlock |
| d. Read Logic | i. Unit Select |
| e. Diskette Drive | |

4.3.1 CONTROL LOGIC

The functions of the control logic are to generate the signals that (a) establish the ready status of the FDD, (b) step the Read/Write heads in or out upon selection and command of the controller, (c) load the heads on the diskette for read/write operations, (d) protect the diskette from writing if the write-protect hole is present, (e) indicate when the Read/Write head is at Track 00, (f) generate the Index and Sector pulses when the diskette is rotating and the FDD is selected, (g) unlock the FDD door latch upon command of the controller through one of four switch-selected control lines, (h) unit selection of the FDD, (i) select head 0 or 1 for Read/Write operation.

- a. The Ready signal is generated when the diskette comes up to proper operating speed. The Index pulses are used to re-trigger the multivibrator (U16 pin 10). The output of this element will remain high on a continuous basis when the repetition rate of the Index pulses is shorter than the time out of U16 pin 10. This logic function is used to control the R/S flip flop U20 to generate the Ready signal. Jumper W30 or DIP switch S2 (5, 6, 7 and 8) allow selection of the relative position of each FDD within the daisy-chain configuration.

- b. At initial voltage application, the two flip flops of U10 and U20 are asynchronously reset through the action of comparator U4. At the instant the 5 V appears, U4 pin 7 will go high, forcing pins 11 and 10 of U13 low, and forcing output pins 7 and 9 of U10 high and pin 8 of U20 high. As capacitor C6 is charged, U4 pin 7 will switch low, assisted by hysteresis. This will cause the reset signal to go high and remain high as long as the +5 volts remains present.
- c. Each step command received initiates a step sequence that controls the stepper motor. Either the logic level of the Direction signal or the use of the Step-In or Step-Out signals determine whether the phase sequence is stepping in or out per Table 4-1.

Table 4-1. Phase Sequence of Stepper Motor

<u>Change the Active ϕ</u>		<u>To Step One Track</u>
<u>From</u>	<u>To</u>	
A	A+B	IN
A+B	B	
B	B+C	
B+C	C	
A	A+D	OUT
A+D	D	
D	C+D	
C+D	C	

Movement of the Read/Write head is initiated by the step-commands from the controller; the head is stepped one track, either toward the spindle (In) or away from the spindle (Out), with each step command. The direction is regulated by the status of the Direction line (a low level of the Direction line causes the Read/Write head to step toward the spindle, and a high level causes the Read/Write head to step away from the spindle) or by commanding either the Step-In or Step-Out Line.

Drive to the specific stepper motor phases, A, B, C, and D is provided by logic-driven Darlington transistors Q2, 3, 4, and 5. Step information is decoded by the programmed ROM (Read-Only Memory) U24 and is used to control the driver transistors. The ROM is controlled by the start-stop sequence generator, U21 pin 7, U28 pin 8, U31 pin 6, U13 pin 12, U10 pin 12, U13 pin 4 and U15 pin 6. The circuit at U28 pin 8 produces a pulse for each trailing edge of U21 pin 6&7. The circuits at U13 pin 4 and U15 pin 6 produce a pulse for each edge change on the input. The sequence generator is started by step pulses from U5 pin 7. It is stopped after the proper sequence by U24 pin 5 shaped by U34 pin 10 and U36 pin 2. The timing of U21 pin 6 controls the speed of the sequence generator and is nominally set at 0.5 ms.

One-shot U25 pin 10 is continuously being retriggered by the step pulse and times out on the last pulse. One-shot U25 pin 10 controls how long +24 volts will be applied to the stepper motor. One-shot U29 pin 9 is triggered by the last step information and is used to control settling time. It triggers U25 pin 6 to reapply +24 volts to the stepper motor for position accuracy. One-shot U29 pin 6 determines

the duration of the reverse step damping. Power on reset will cause the stepper motor to sequence to ØA by resetting U10.

- d. The Read/Write heads of a selected FDD can be loaded when the disk is fully installed and the front panel door is closed. Closing the front-panel door actuates the door interlock switch which completes the circuit to the head-load solenoid. When the controller sends a Head-Load signal, the head-load solenoid is energized causing the armature bail to actuate. The actuation of the bail permits the head arms to load the heads against the diskette surface.

The head is loaded by energizing the solenoid through R83 which slows down the pull-in of the solenoid. After a delay, full current is applied to the solenoid through Q8.

- e. The Write-Protect function is accomplished through use of an LED (light-emitting diode) and a photo-transistor. These are mounted such that the presence of a Write Protect slot in the jacket of the diskette will cause pin 14 of comparator U32 to be driven high. This signal is gated with Unit Select and Write Enable to inhibit writing on any diskette possessing a write-protect slot.
- f. Track 00 signal is generated when the carriage assembly tab is sensed by the Track 00 optical switch. Closing this switch causes U32 pin 13 to switch low assisted by hysteresis. The output of U13 (pin 2) is gated with ØA, Unit Select, and Step Out direction to provide the Track 00 signal that is transmitted to the controller from U23 pin 3.
- g. The beginning of each diskette track is indicated by an Index pulse. The diskette rotates between a light source (LED) and a sensor (photo transistor). When the Index hole in the diskette passes over the light source, light is detected by the sensor. The sensor output is amplified and transmitted to the controller as the Index pulse when the FDD is selected.

The unit has two Index detectors, one for two-sided diskettes and one for single-sided diskettes. Latch U6 pin 3 and U6 pin 6 determine the type of diskette involved. U6 pin 6 is set low for a two-sided diskette and high for a single-sided diskette. This signal is gated with Unit Select and sent to the interface by U23 pin 6.

Two-sided and single-sided Index is gated at U9 pins 1 and 2 and is provided to U5 pin 12 for shaping.

An Index/Sector separator can be provided on the FDD for use with hard-sectored diskettes. Proper operation of the Ready function requires that the Index pulses be separated in the FDD. The composite Index/Sector signal is applied to input pin 11 of one-shot multivibrator U21. Feedback from output pin 10 to input pin 12 causes the one-shot to be non-retriggerable. ANDing the two outputs with the composite Index/Sector signal provides the separated Index and Sector signals.

- h. The Door Unlock function enables the controller to activate a door-unlocking solenoid and LED indicator by applying a low level to one of four jumper or switch-selectable control lines. These lines are not gated with Unit Select. The four unlock positions of dipswitch S2 are 13, 14, 15, and 16.
- i. The Unit Select function inhibits all command and status signals except Door Unlock and Ready. The position of the FDD in the daisy-chain configuration is determined by the activation of switches 1, 2, 3, and 4.

4.3.2 WRITE AND FAULT LOGIC

A write operation begins with a Write Enable command from the controller when the FDD is selected. This command simultaneously enables the Write-Data switching drivers (flip flop U11 pins 5 and 6), the Write-Data gate U33 pin 6, blocks the input to the read circuit by reverse-biasing diodes in U22, and after a delay energizes the erase windings. Data applied to the Write-Data input alternately switches a constant write current through the write drivers to the head windings. Low-Current operation, used when writing on track 43 or greater, is selected by switching a shunt resistor R55 into the write current source. The current source U30 provides current to the emitters of the write transistors U30.

Head-Select signal when low selects head 0 by turning on U35 pin 14 causing its collector to be at +12 volts while U35 pin 8 is at ground. When the Head-Select signal goes high, it will cause U35 pin 14 to ground and U35 pin 8 to +12 volts selecting head 1. Q7 and U35 pin 7 control the +12 voltage with respect to loss of +5 control voltage.

A Write-Fault signal is generated if Write Enable is commanded and the head is not loaded (head-load solenoid not energized), or Write Enable is commanded and no data is applied, or Write Enable is commanded but Write Data is applied at the wrong rate. Either one or both of the conditions sets the Write-Fault latch U12. Commanding a Write-Fault Reset clears the Write-Fault signal by resetting the Write-Fault latch.

4.3.3 READ LOGIC

Read operation is enabled when the Read/Write heads are loaded on the diskette and Write Enable is not commanded. With Write Enable not commanded, the data blocking diodes U22 are forward-biased and data sensed by the Read/Write head is fed to the Read Data circuit. The read signal from the diskette is in the form of a sine wave.

This analog signal is amplified by U18, filtered, differentiated by C22/R24 and C23/R25, amplified by U8, and coupled to a comparator/logic circuit to detect zero crossings and reject noise in the differentiated read signal.

The out-of-phase comparators U1 pins 7 and 12 have rise and fall times whose differences are exaggerated by slow-down capacitor C5. This results in a narrow negative pulse at U9 pin 11 which triggers a one microsecond retriggeable one-shot, U2 pin 9.

Flip flop U11 pins 8 and 9 perform a noise-rejection function in that noise near the zero crossings of the amplified differentiated data only result in retriggeing U2 pin 9. This appears as jitter in the clock for the flip flop whose data input, derived from redundant comparator U4 pin 12, has by that time stabilized.

Another slow-down capacitor, C27, causes a negative pulse to appear at the output of U9 pin 8 whenever the flip flop toggles. Although shifted in time by approximately the delay of one-shot U2 pin 9, each pulse corresponds to a zero crossing of the differentiated signal, and a peak of the analog read signal. Jitter at the flip-flop clock input and U9 pin 8, which is due to noise at the zero crossings, will not affect the 250-ns composite-data pulse width.

4.3.4 DISKETTE DRIVE

Diskette drive is accomplished by clamping the diskette between the cone assembly and a belt-driven spindle. The spindle is rotated at 360 r/min by the diskette drive motor. A dual pulley permits 50 or 60 Hz operation without a motor change.

4.3.5 READ/WRITE HEADS

The Read/Write heads are in direct contact with the diskette during read or write operation. Head load is achieved by a solenoid-actuated bail allowing the head arms to load the Read/Write heads against the diskette. The head surfaces are designed for maximum signal transfer to and from the magnetic surface of the diskette with minimum head/disk wear. The tunnel-erase gap DC-erases the intra-track area to improve off-track signal-to-noise ratio and permit diskette interchange between units.

4.4 CONTROL AND DATA LINE CHARACTERISTICS

All signal lines must be terminated at the receiver with a characteristic impedance of 120 ohms, typically. Transmission is by 26 AWG (min.), 120-ohm flat cable or twisted pair (one twist per inch) with a maximum line length of 25 feet. Figure 5-1 shows the timing of typical operations.

4.4.1 LOGIC LEVELS

The following definitions will be used throughout this manual:

low = Logic 1, Active State	Refers to the low-voltage condition +0.4VDC Max.
high = Logic 0, Inactive State	Refers to the high-voltage condition +2.4VDC Min.

4.4.2 TRANSMITTER CHARACTERISTICS

The FDD uses the TTL7438 (quad 2-input buffer or driver) or equivalent to transmit all control and data signals. This transmitter is capable of sinking a current of 48ma with an output voltage of 0.4 volts.

4.4.3 LINE-RECEIVER CHARACTERISTICS

The FDD uses the SN7400 family gates or equivalent for line receivers. The input of each receiver is terminated in 120 ohms.

4.4.4 CONTROL AND DATA LINE FUNCTIONS

The signals that are exchanged are described in Table 4-2 and are shown relative to a point of origin in Figure 4-1.

SIGNAL	FUNCTION
<u>INPUT LINES</u>	
-STEP } **	A 10 microsecond (minimum) logic 1 level pulse on this line causes the head to move one track as determined by the direction line.
-DIRECTION }	A logic 1 level on this line and step pulse causes the head to move one track inward toward the center of the diskette. A logic 0 level on this line and step pulse causes the head to move one track outward from the center of the diskette.
-STEP IN } **	A 10 microsecond (minimum) logic 1 level pulse on this line causes the head to move one track inward from the center of the diskette.
-STEP OUT }	A 10 microsecond (minimum) logic 1 level pulse on this line causes the head to move one track outward from the center of the diskette.
-HEAD LOAD	A logic 1 level on this line loads the heads against the diskette.
**Only one pair of signals per FDD.	

Table 4-2. Input/Output Lines

Table 4-2. (continued)

SIGNAL	FUNCTION
<u>INPUT LINES</u>	
-WRITE ENABLE	To enable the FDD write driver, this line is held at a logic 1.
-WRITE FAULT RESET	A logic 1 level on this line clears the Write-Fault latch.
-WRITE DATA	This line contains the composite coded write clock and data information to the FDD. Information to be recorded on the diskette is derived from the transition of each pulse from logic 1 to logic 0 if W8 is present, or from logic 0 to logic 1 if W7 is present on the PWA.
-LOW CURRENT	This line reduces write current for tracks 43 or greater. A low level reduces write current.
-UNIT SELECT	On this line a logic 1 level with W24 and W26 present or a logic 0 level with W25 present enables the FDD interface except for -Door Unlock and -Ready.
-DOOR UNLOCK	A logic 1 level on this line illuminates an LED indicator on the front panel of the FDD and activates a solenoid which unlocks the door-latch mechanism, permitting manual opening of the door.
HEAD SELECT	A high level on this line selects head 0 (lower diskette surface). A low selects head 1.
<u>OUTPUT LINES</u>	
-READY	A logic 1 level indicates that the door is closed and a diskette is rotating.
-INDEX	This line gives an indication of the rotational position of the diskette by outputting a logic 1 pulse for every Index hole of the diskette.

Table 4-2. (continued)

SIGNAL	FUNCTION
<u>OUTPUT LINES</u>	
-SECTOR	This line gives an indication of the rotational position of the diskette by outputting a logic 1 pulse for every sector hole of the diskette.
+WRITE FAULT	A logic 0 level indicates one or more of the following fault conditions. -Write Enable without head load. -Write Enable without write data. Incorrect write data rate.
-WRITE FAULT	A logic 1 level indicates one or more of the following fault conditions. -Write Enable without head Load. -Write Enable without write data. Incorrect write data rate.
-TRACK 00	A logic 1 level indicates that the head is positioned over Track 00.
-WRITE PROTECT	Logic 1 level indicates that the slot on the diskette is uncovered.
-READ DATA (Composite)	This line contains the unseparated data and clock information.
DISKETTE TYPE	This line is low for a two-sided diskette and high for a single-sided diskette.

DIAGRAMS

5.1 INTRODUCTION

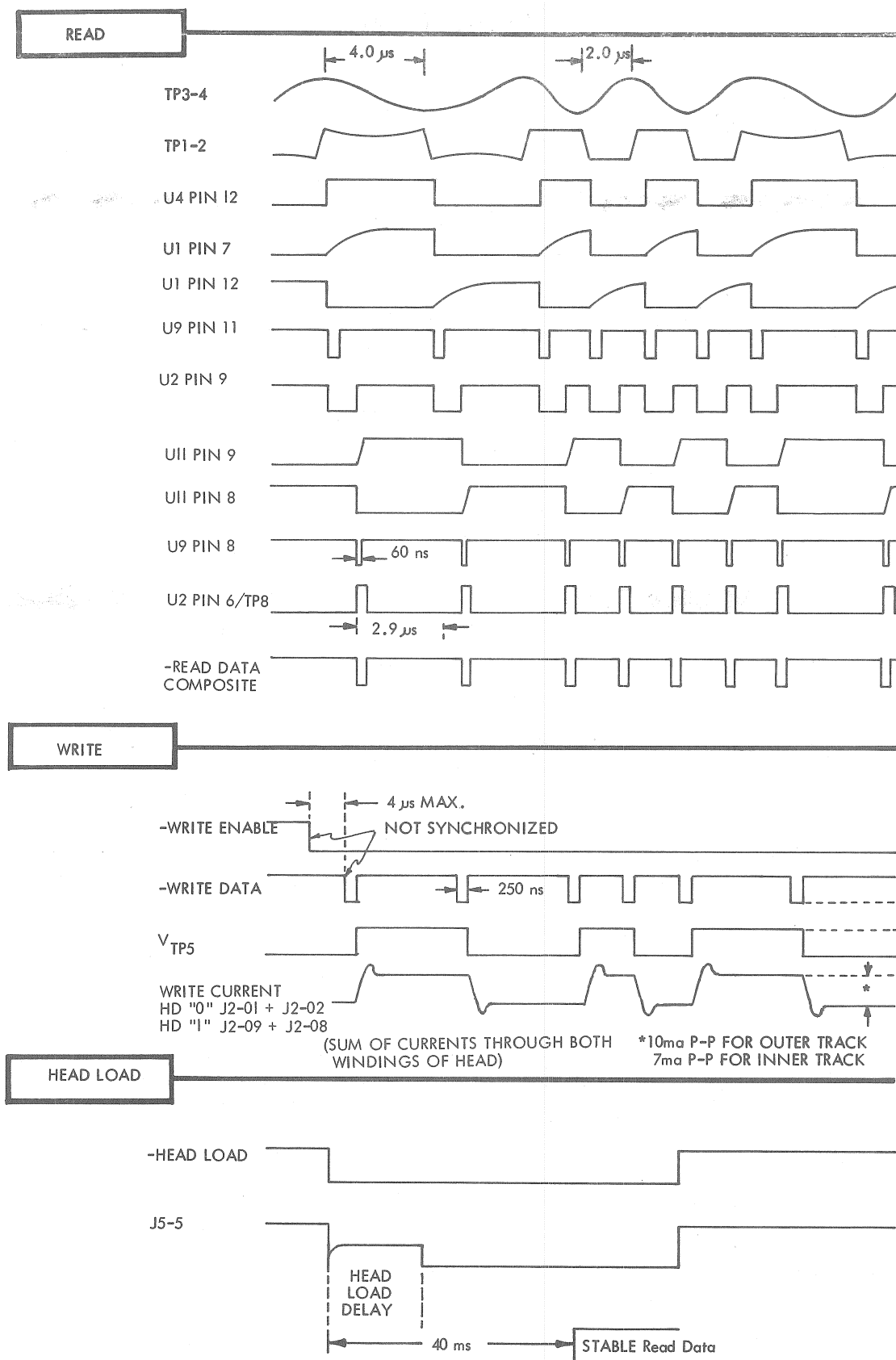
This section contains the printed-circuit-board documentation and related timing diagrams. This documentation applies to the printed-circuit boards listed in Table 5-1. Refer to the Configurator sheet, located in the front of the manual, to determine the assembly number of the circuit board being serviced.

Figure 5-1 shows timing diagrams which illustrate signal/time relationships during read, write, step-in and step-out operations. Figure 5-2 is the printed-circuit board schematics and Figure 5-3 contains the assembly drawing and parts list.

Table 5-1. PWA Configurator

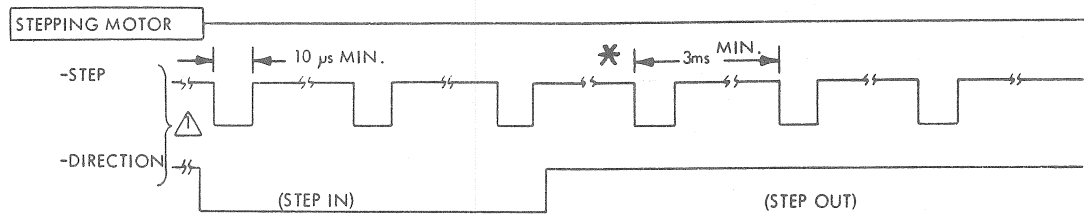
OPTION CHART	PWA CONFIGURATION CIRCUIT BD. IDENT. NO. 77615XXX													7764 XXXX
	HPC 77618:xxx	000	001	002	003/039	004/040	005/041	015	016	018	028	029	019	033
HOOR METER														
WRITE PROTECT (INH WRT)					400	400	400				400			
WRITE PROTECT (NOT INH WRT)		300	300	350				930	930	350		2400	2400	9150
DATA CLOCK SEPARATION														
SECTOR SEPARATION														
UNIT SELECT (HIGH)				350						350				
UNIT SELECT (LOW)		300	300					930	930			2400	2400	9150
READY		300	300	350	400	400	400	930	930	350	400	2400	2400	9150
DOOR UNLOCK (WITH POWER)														
DOOR UNLOCK (WITHOUT POWER)								930	930					9150
WRITE FAULT		300	300	350	400	400	400			350	400	2400	2400	
WRITE DATA INVERT														
INDEX SINGLE SIDED		300	300	350	400	400	400	930	930	350	400	2400	2400	9150
DISKETTE IN PLACE														
EXTERNAL ERASE ENABLE														
HEAD LOAD WITH UNIT SELECT														
ACTIVITY LED (UNIT SELECT)												2400	2400	
ACTIVITY LED (HEAD LOADED)					400	400	400				400			
ACTIVITY LED (DOOR IS LOCKED)														
ACTIVITY LED (DOOR IS UNLOCKED)														
STEP IN/OUT														
INTERFACE CONNECTOR TYPE		A	A	A	C	C	C	A	A	A	C	A	A	A
WRITE PROTECT FAULT					400	400	400				400			

XX121b



XX120a

Figure 5-1a. Timing (Sheet 1 of 2)



*Change in direction time = settling time = 20 ms

(X258a)

Figure 5-1b. Step/Direction Operation

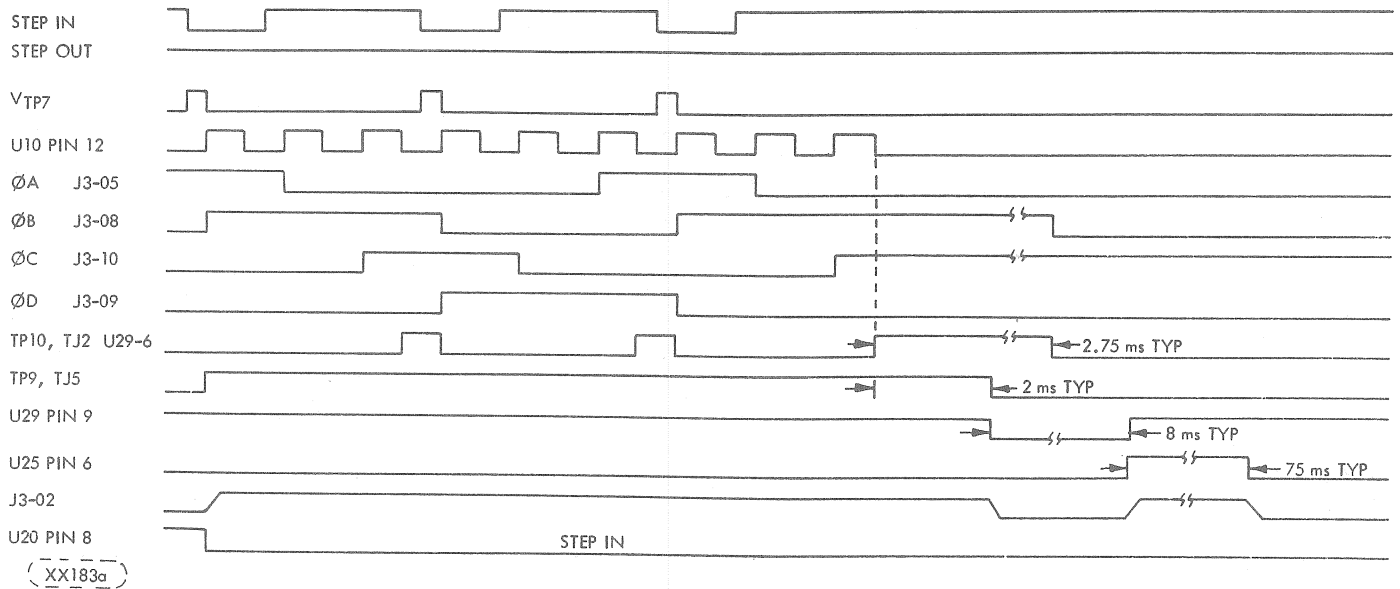


Figure 5-1c. Step-In Operation

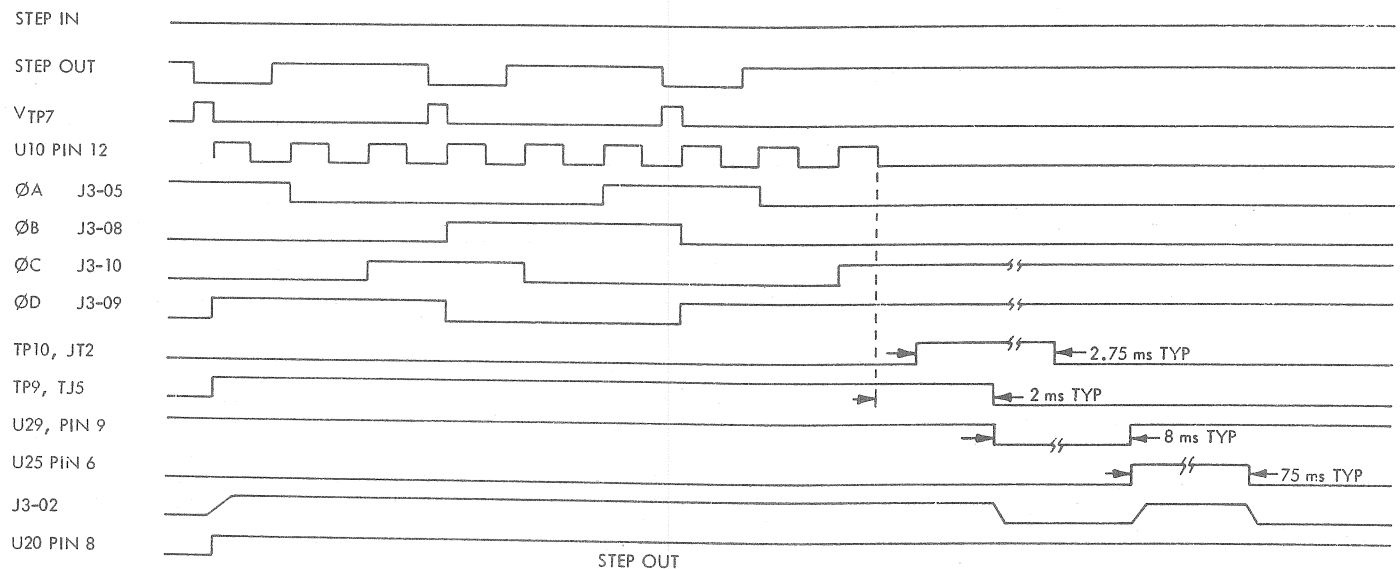


Figure 5-1d. Step-Out Operation (Sheet 2 of 2)

JI PIN CONFIGURATION AND ASSEMBLY USAGE							
FUNCTION NAME	77615400 77630751	77615352 77618301 77632401	77618931 77649151	77667400 77666400			
- CLOCK SEPARATED	--	--	--	--			
- DIRECTION	38	14	14	14			
DISK TYPE	36	50	50	50			
DOOR UNLOCK - 1	--	--	--	42			
- DOOR UNLOCK - 2	--	--	--	48			
- DOOR UNLOCK - 3	--	--	--	--			
- DOOR UNLOCK - 4	--	--	--	--			
- ERASE ENABLE	--	--	--	--			
- HEAD LOAD	26	04	04	04			
HEAD SELECT	32	40	40	40			
- INDEX	28	08	08	08			
- LOW CURRENT	44	10	10	10			
- READ DATA COMPOSITE	34	02	02	02			
- READ DATA SEPARATED	--	--	--	--			
- READY - 1	12	28	28	28			
- READY - 2	--	30	30	30			
- READY - 3	--	32	32	32			
- READY - 4	--	34	34	34			
- SECTOR	--	--	--	--			
- STEP	46	12	12	12			
- TRACK 00	30	06	06	06			
- UNIT SELECT - 1	--	20	20	20			
- UNIT SELECT - 2	--	22	22	22			
- UNIT SELECT - 3	--	24	24	24			
- UNIT SELECT - 4	--	26	26	26			
- WRITE DATA	42	18	18	18			
- WRITE ENABLE	40	16	16	16			
- WRITE FAULT	--	44	44	44			
+ WRITE FAULT	50	--	--	--			
- WRITE FAULT RESET	48	46	46	46			
- WRITE PROTECT	24	36	36	36			
- STEP IN	--	--	--	--			
- STEP OUT	--	--	--	--			
2 - SIDED FDD	--	--	48	--			
GROUND	1-41 & 49 ODD NO-ONLY EXC + 24V RET	1-41 & 49 ODD NO. ONLY	1-41 & 49 ODD NO. ONLY	1-41 & 49 ODD NO. ONLY			
+ 24 VOLT RETURN	17,19,21	--	--	--			
+ 24 VOLTS	18,20,22	--	--	--			
+ 5 VOLTS	2, 4, 6	--	--	--			

(66271)

Figure 5-2. Schematics (Sheet 1 of 8)

ASSEMBLY NO.	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18
77615400				X				X	X		X	X		X	X	X		
77615352			X					X			X			X	X	X	X	X
77618301			X					X			X			X	X	X		X
77618931			X					X			X			X	X	X		X
77632401			X					X			X			X	X	X		X
77649151			X					X			X			X	X	X		X
77630751				X				X	X		X	X		X	X	X		
77666400			X		X			X			X			X	X	X		X
77667400			X		X			X			X			X	X	X		X

(GG272a)

ASSEMBLY NO.	W19	W20	W21	W22	W23	W24	W25	W26	W27	W28	W29	W30	W31	W32	W33	W34	W35	
77615400				X	X		X		X			X			X	X		
77615352					X	X		X								X		
77618301					X		X									X		
77618931					X		X									X		
77632401		X			X		X									X		
77649151		X			X		X									X		
77630751				X	X		X		X			X			X	X		
77666400			X		X		X									X		
77667400			X		X		X									X		

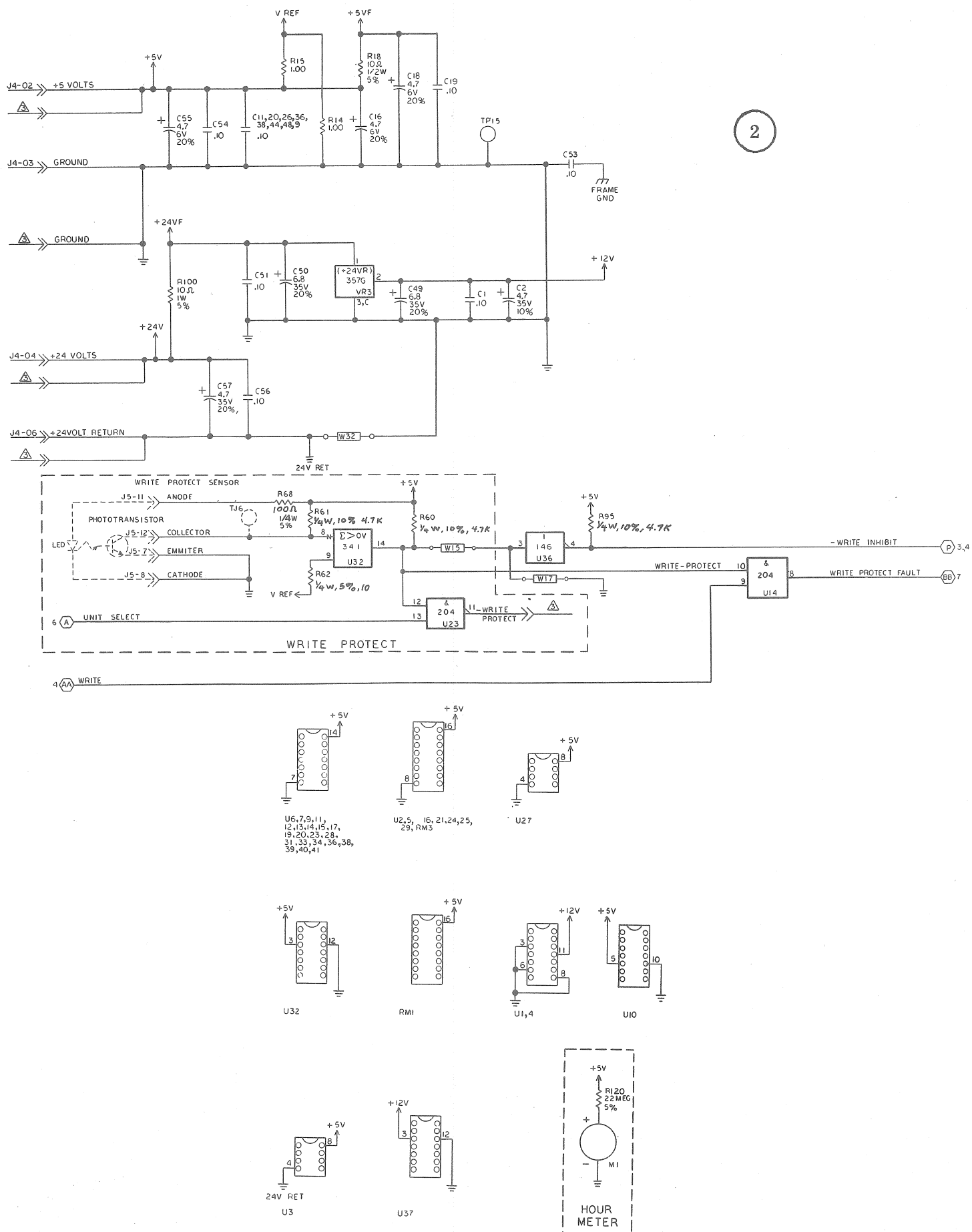
(GG272b)

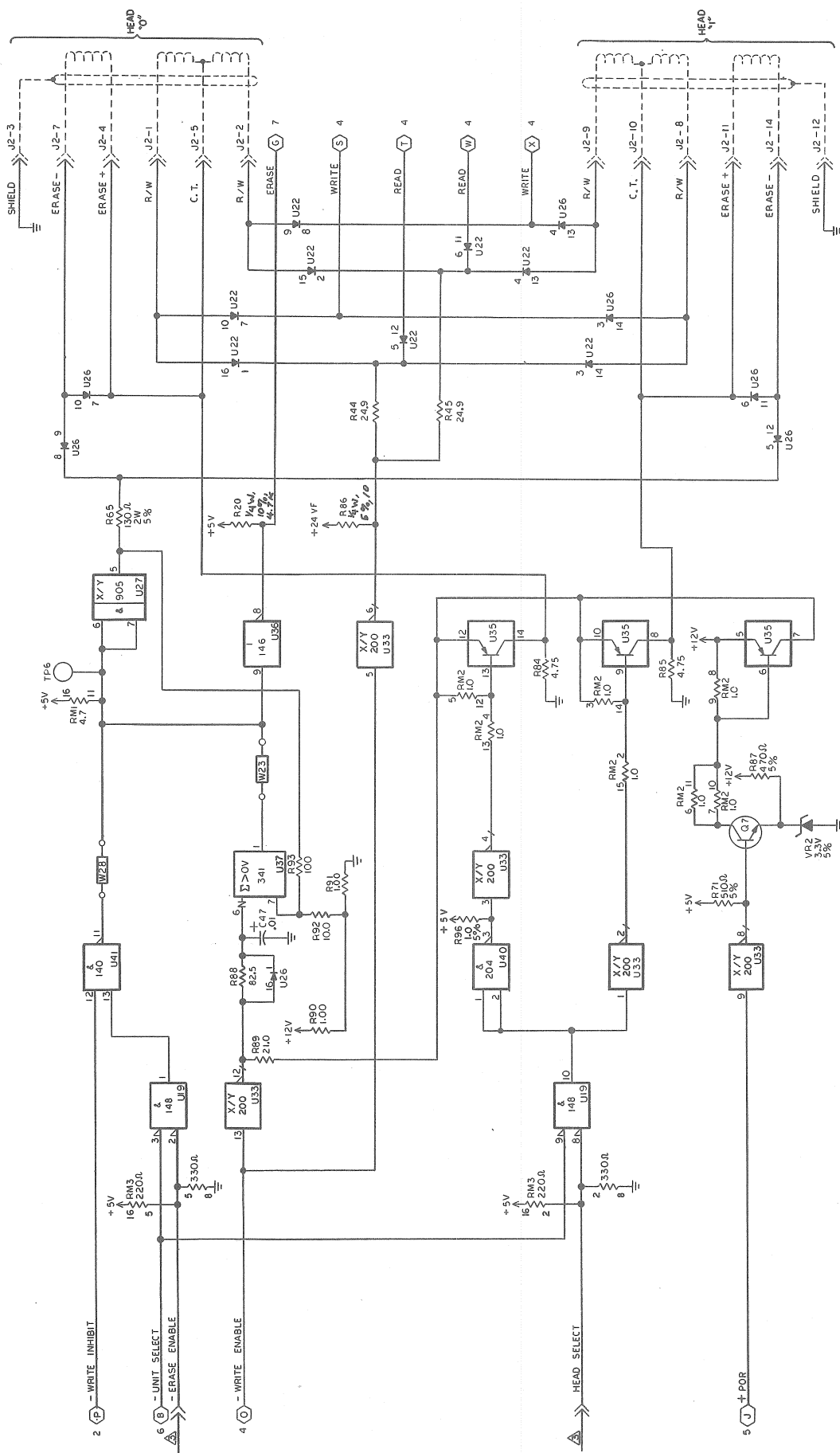
NOTES:

UNLESS OTHERWISE SPECIFIED:

1. RESISTOR VALUES ARE IN K-OHMS, 1/4W. 1%
2. CAPACITOR VALUES ARE IN MICRO-FARADS
3. SEE TABLE FOR J1 CONNECTOR PIN DESIGNATIONS ALL OTHER CONN NOS SHOWN IN BODY OF SCHEMATIC
4. DOTTED BOXES INDICATE OPTIONS
5. ONLY ONE (MECHANICAL OR OPTICAL) SWITCH IS USED PER FDD

Figure 5-2. Schematics (Sheet 2 of 8)





3

Figure 5-2. Schematics (Sheet 4 of 8)



5-7

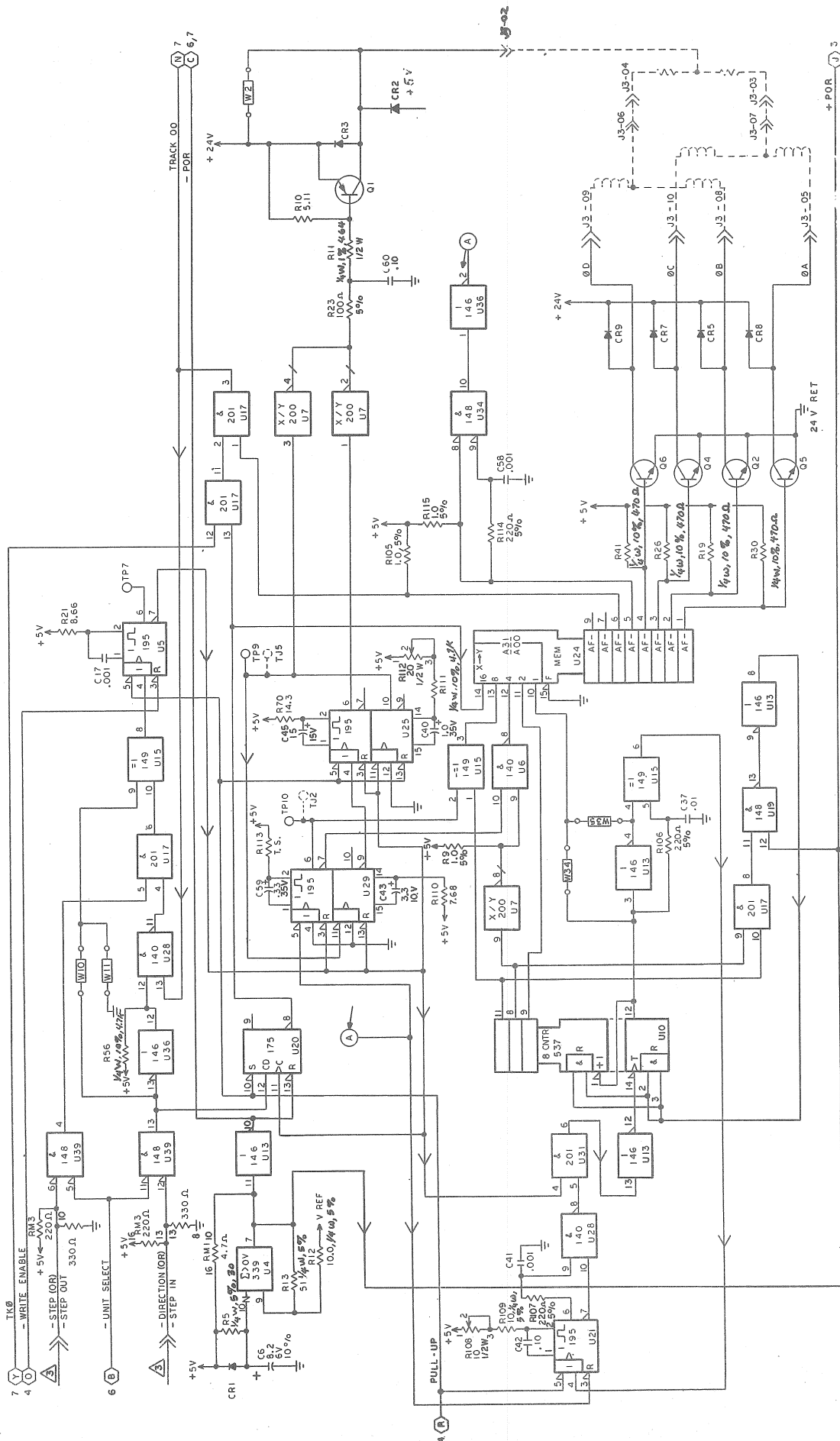
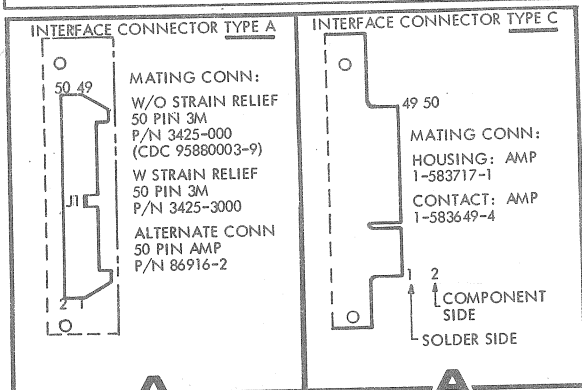
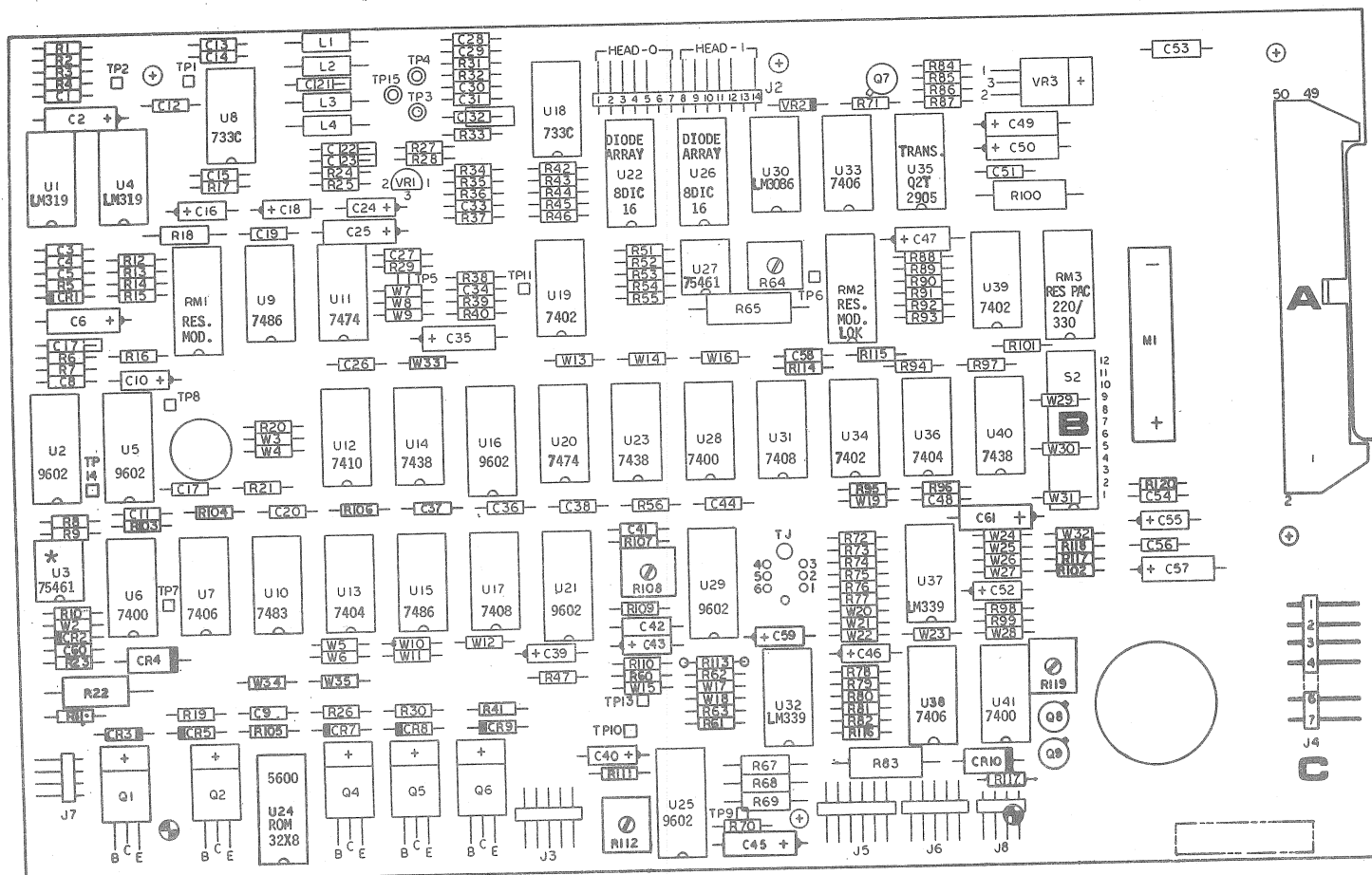


Figure 5-2. Schematics (Sheet 6 of 8)



77614903-AE



TRANSISTORS:
Q1 - T1P125
Q2, Q4, Q5, Q6 - T1P120
Q7, Q8, Q9 - NPN

DIODES:
CR1 - 1N914A
CR2, CR3, CR5, CR7, CR8,
CR9, CR10 - 1N4001

***NOT USED ON SOME
PWA CONFIGURATIONS.**

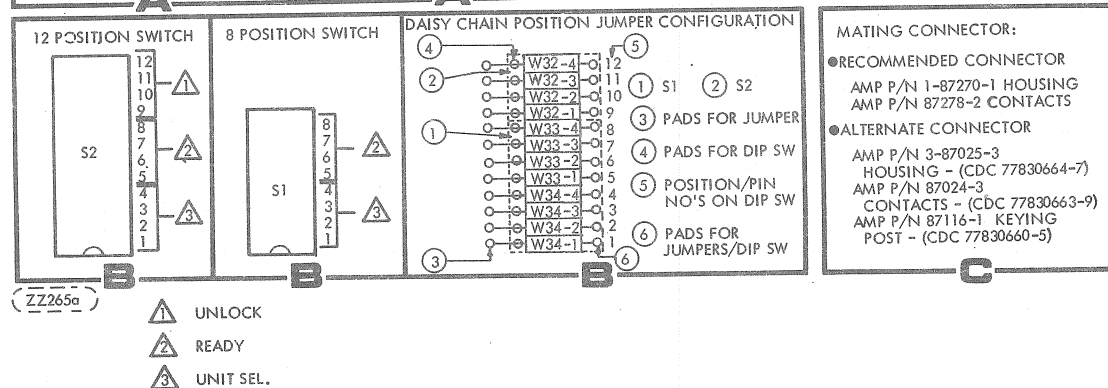


FIGURE 5-3. ASSEMBLY AND PARTS LIST (SHEET 1 OF 5)

MAINTENANCE

6.1 INTRODUCTION

This section contains the instructions required to maintain the FDD. The information is provided in the form of preventive maintenance, troubleshooting and corrective maintenance.

6.2 MAINTENANCE TOOLS

The Special tools (or equivalent) required to maintain an FDD are as follows:

<u>DESCRIPTION</u>	<u>CDC MODEL NO.</u>
Alignment Diskette (Single-Side, Optional)	421-51W
Alignment Diskette (Two-Sided)	425-51W

6.3 TROUBLESHOOTING

An improperly adjusted FDD may exhibit symptoms of one that has a malfunction; therefore, the Adjustment Procedures (paragraph 6.4) should be performed before assuming that the unit has failed. Before troubleshooting is started, check all DC supply voltages.

6.3.1 DC VOLTAGE AND SIGNAL CHECK

- Input power should be $+5\text{VDC} \pm 5\%$ and $+24\text{VDC} \pm 10\%$ measured at the input to the FDD (refer to paragraph 3.4.2).
- Test Points: The signals at the test points should conform to the various diagrams and waveforms as listed in Table 6-1.
- Signals should conform to Figure 5-1 and Figure 6-1 through 6-4.

Table 6-1. Test Points

Test Point No.	Refer to Fig. No.	Comments
1	5-1	Differentiated Analog
2	5-1	Read Data (Differential)
3	5-1, 6-2, 6-3	Analog Read Data
4	5-1, 6-2, 6-3	(Differential)
5	5-1, 6-4	Write flip flop
6	- - -	Not for Field Use*
7	5-1	Stepper One-Shot
8	5-1	+Composite Read Data
9	5-1	Stepper Steering Logic
10	5-1	Stepper Steering Logic
11	- - -	Not for Field Use**
12	- - -	Not Used
13	5-1	Sector One-Shot
14	5-1	Index/Sector
15		Ground

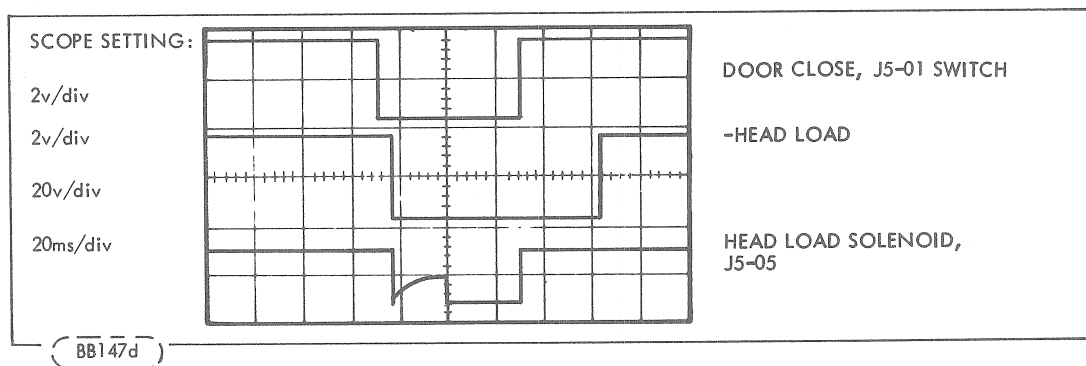


Figure 6-1. -Head-Load and Door-Close Switch

*Erase current should be 80mA typically into J2-03 when the FDD is Write-Enabled.

**A Write Fault should occur when the FDD is Write-Enabled and no Write Data is sent.

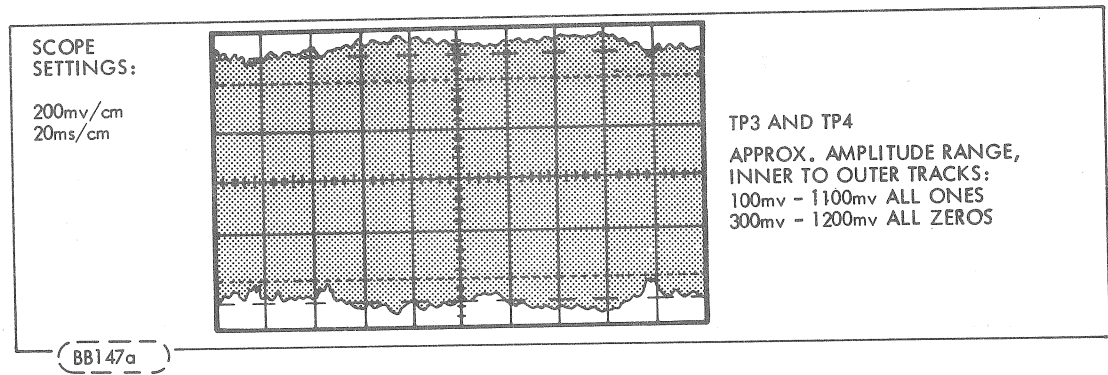


Figure 6-2. Differential Read Signal for Entire Track

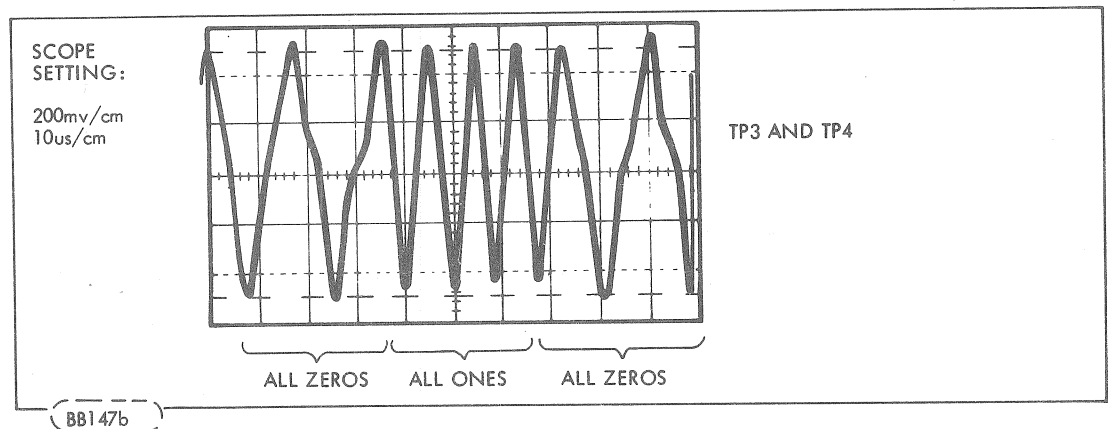


Figure 6-3. Differential Read Signal for Portion of Outer Track

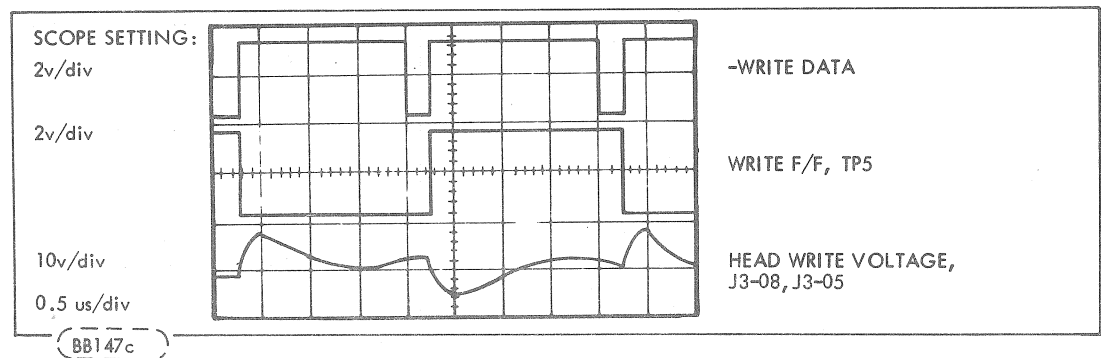


Figure 6-4. Write Data, Write F/F Output, and Head Write Voltage for Outer Track

6.4 ADJUSTMENT PROCEDURES

6.4.1 WRITE-SPLICE CHECK AND ADJUSTMENT

Alignment Diskette 421-51W and 425-51W are used to perform this procedure.

- a. Precondition the alignment diskette by allowing it to reach room temperature for one hour.
- b. Install the alignment diskette.

CAUTION

The Alignment Diskette is for read only. Extreme caution should be used to assure this diskette is not written on.

- c. Seek to Track 00, then seek to Track 01 and Read on head 0. (No data is recorded on Track 1.)
- d. Connect Channel 2 of scope to TP3 on the PWA, Channel 1 to Index TP14 of the PWA. Set up the scope as follows:

Chan 2 Volt/Div to: 0.1 volt/div
Chan 1 Volt/Div to: 2 volt/div

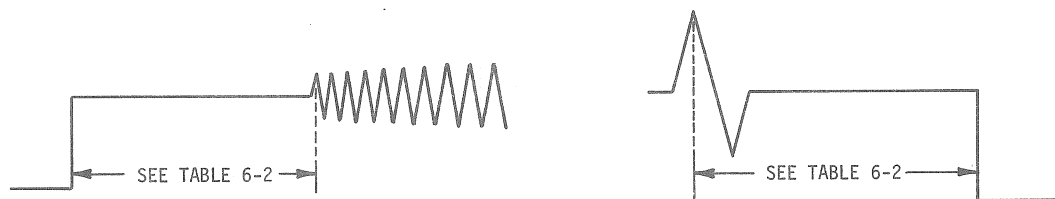
Chan 2 voltage to: AC
Chan 1 voltage to: DC

Vert. Mode to: Add Trig. Mode to: Channel 1
Slope (Sync) to: Pos. Time Base to: 50 μ s/div

- e. Adjust the time of the write-splice bit until it measures per Table 6-3. Refer to Figure 6-5a to adjust the write Index-to-Burst time, loosen the single-sided sensor set screw holding the (single-sided-sensor) phototransistor located on the bottom of the chassis toward the front of the unit, (Figure 6-5b). Using the adjustment tab protruding through the casting, move the phototransistor until the specification is met. Tighten the set screw while observing the scope signal. Verify that the adjustment did not change.
- f. All scope settings are to remain as defined in the original setup in Step d, but it may be necessary to slightly adjust the sync. Seek to Track 00 then seek to Track 01 and perform a read. While observing the signal on the scope, remove and reinsert the diskette three times.

After each insertion, verify that the change in the time from Index to write splice is less than 50 μ s.

Repeat Steps b through f using Alignment Diskette 425-51W for the two-sided sensor adjustment tab and its associated set screw, as required.



ZZ164a

Figure 6-5a1.

Figure 6-5a2.

Write-Splice Timing

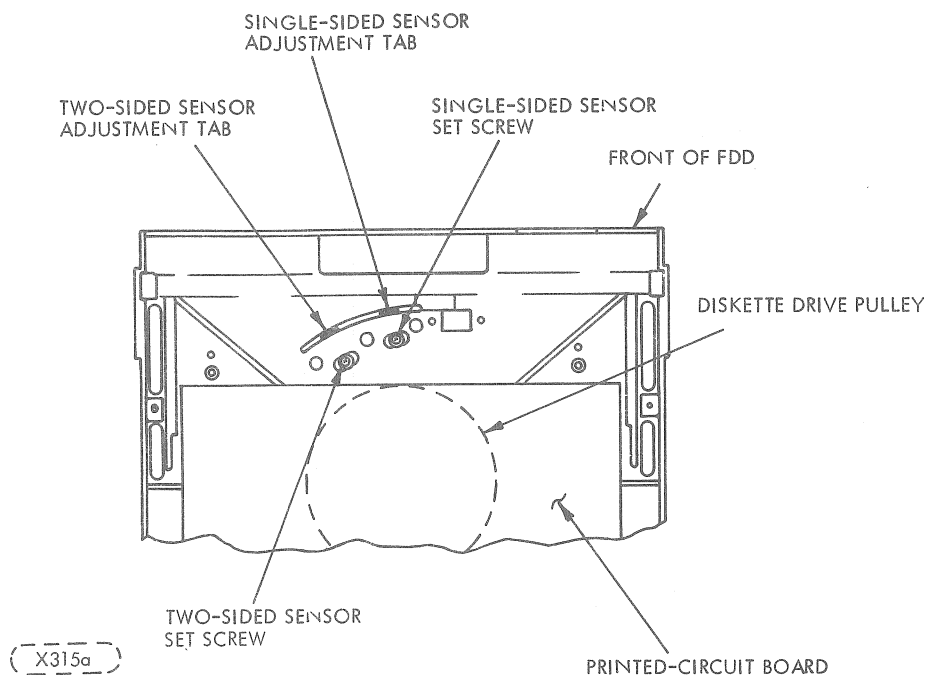


Figure 6-5b. Single- and Two-Sided Sensor Adjustment Means

Table 6-2. Write-Splice Adjustment

HPC. REF. NO.	WRITE SPLICE ADJ. (μ s)		WRITE SPLICE ADJ. (μ s)	
	2 SIDED SENSOR		1 SIDED SENSOR	
	Time	Figure	Time	Figure
77618003	200 $\pm$ 100	6.5a1	450 $\pm$ 100	6.5a2
77618004	200 $\pm$ 100	6.5a1	450 $\pm$ 100	6.5a2 I
77618005	200 $\pm$ 100	6.5a1	450 $\pm$ 100	6.5a2 I
ALL OTHERS	200 $\pm$ 100	6.5a1	200 $\pm$ 100	6.5a1

6.4.2 ACTUATOR ALIGNMENT (Diskette)

- a. The alignment diskette shall be preconditioned by allowing it to reach room temperature for one hour.
- b. Install the alignment diskette.

CAUTION

The alignment diskette is for read only.
Extreme caution should be used to assure
this diskette is not written on.

- c. Step to Track 38 (00100110) and perform a read on head 0. (No data is recorded on Track 38. The tester or system requirements should be noted; refer to tester or system instructions for operation).
- d. Connect Channel 1 of scope to TP3 on the PWA and Channel 2 to TP4 on the PWA.
- e. Connect the external sync probe to index at TP14 on PWA.

f. Set up the scope as follows:

Channel 1: volts/div to: 0.1 volts/div
Channel 2: volts/div to: 0.1 volts/div (inverted)
Channel 1: input to: AC
Channel 2: inputs to: AC

Vertical Mode to: Add
Slope (Sync) to: Positive
Trigger Source to: External
Trigger Coupling to: Low Frequency (High Frequency Reject)
Trigger Mode to: Normal
Time Base to: 20 ms/div

NOTE

Scope trace after trigger level is adjusted for repetitive trace should display an envelope of data "Cateyes" consisting of two lobes (refer to Figure 6-6A).

- g. Change the volts/div of Channel 1 and Channel 2 to 0.02 volts/div. For an acceptable aligned unit, the voltage ratio of the smaller lobe to the larger lobe should exceed 80%.
- h. If not in alignment, loosen the stepper-motor-adapter mounting screws and slowly rotate the stepper motor to adjust the amplitude until the amplitude of both lobes is the same. Small increments of motion can be easily achieved by placing the blade of a flat-blade screwdriver against the adapter main will at the locations shown in Figure 6-11, and then tapping lightly on the screwdriver handle.

CAUTION

Do not tap against the motor.

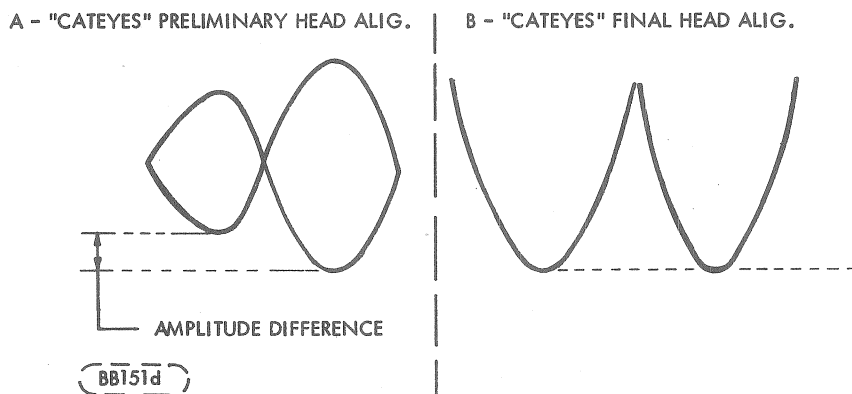


Figure 6-6. Head-Alignment Amplitude

- i. Tighten the stepper-motor adapter screws. Return to Track 00, then seek back to Track 38. Verify that the specification is still met. If the specification is not met, readjust the stepper motor, return to zero and seek back to Track 38. Repeat the adjustment until the specification is met.
- j. Remove alignment diskette.
- k. Perform 6.4.4.

6.4.3 CLAMSHELL-CLOSED SWITCH ADJUSTMENT

Close the clamshell and check that it is latched. Turn the setscrew clockwise until the switch makes contact. Turn the setscrew one additional turn and a half. Open and close the clamshell several times while observing the door-closed signal.

6.4.4 TRACK 00 OPTICAL SENSOR ADJUSTMENT

Adjust the Track 00 optical sensor for the output in Figure 6-7 while the FDD alternately seeks at $3 \text{ ms} \pm 0.1 \text{ ms}$ per step between Track 00 and Track 03.

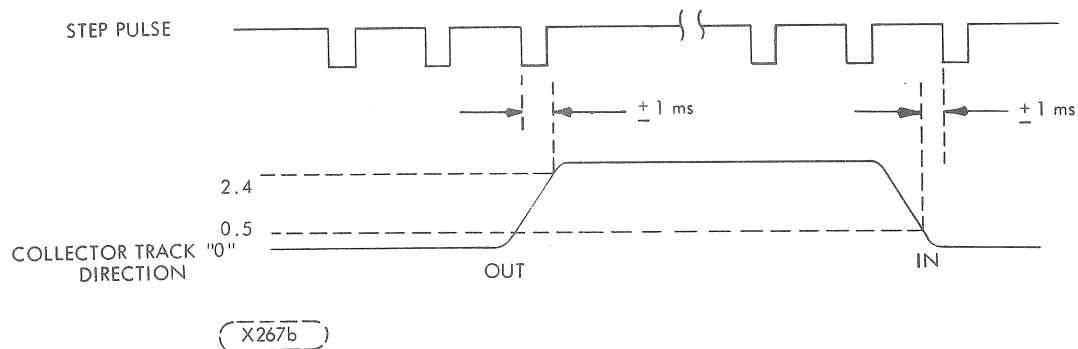


Figure 6-7. Track 00 Optical Sensor Output

6.4.5 DISKETTE EJECTOR

Insert a diskette fully and note a clicking noise as the ejector engages a pin on the clamshell.

While observing the ejector, latch and latch block (Figure 6-8 through the 1/2 in. (12.7 mm) hole in the sidewall, close the clamshell. Note that closing the clamshell moved the ejector further to the rear allowing the latch to rotate counterclockwise until the tip drops over the step in the latch block.

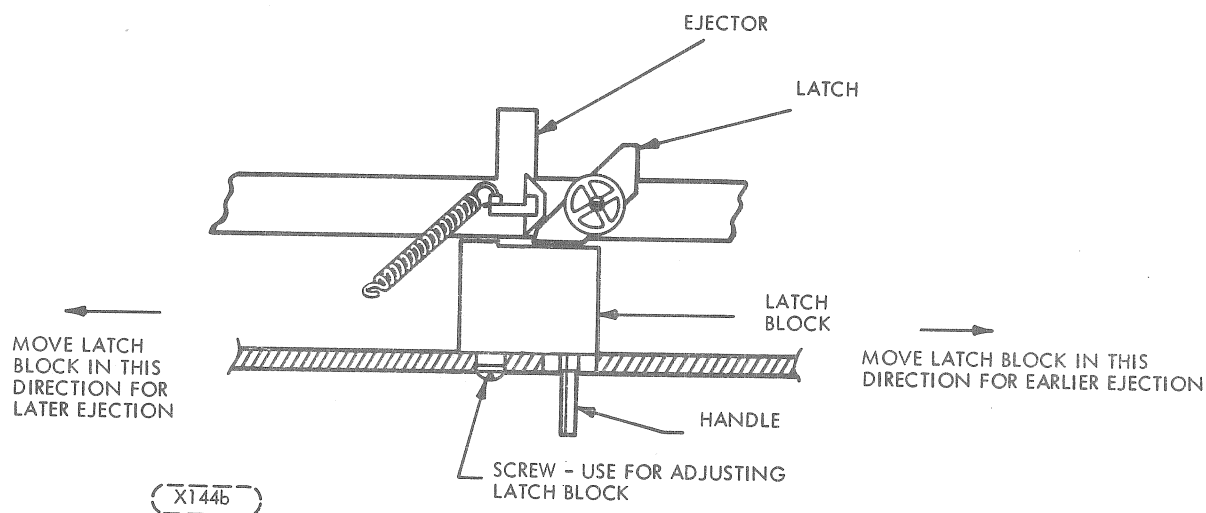


Figure 6-8. Ejector, Latch and Latch Block

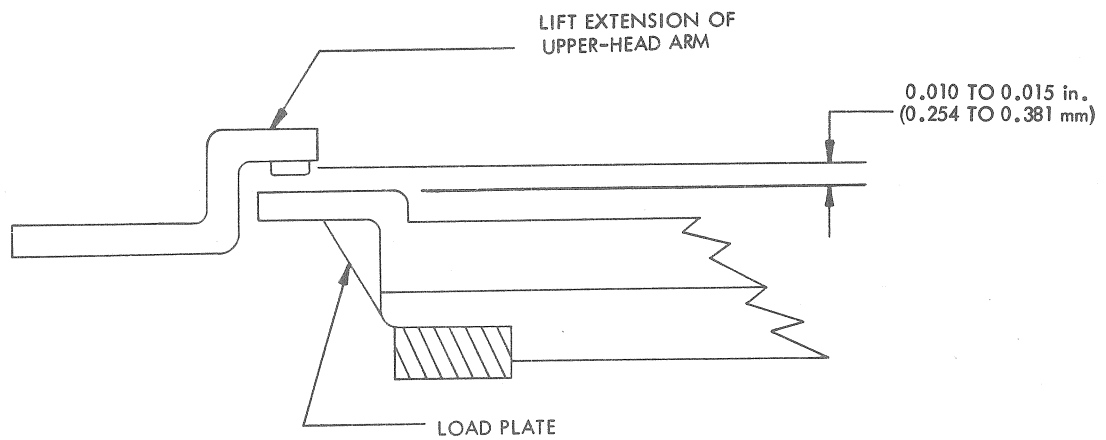
With the clamshell closed, adjust the latch block (Figure 6-8) so the tip of the latch just clears the step.

Check by opening the clamshell slowly and observing the clamshell position when the diskette is ejected. To avoid damage, it is to be ejected when the clamshell is 1/4 in. (6.35 mm) max. from the fully opened position. If further adjustment is required, move the latch block as indicated by the arrows and instruction in Figure 6-8.

Operate several times and observe that the diskette ejection is within the 1/4 in. (6.35 mm) max. described above.

6.4.6 DISKETTE-LOAD-PAD ADJUSTMENT

- Refer to Figure 6-9.
- Energize Solenoid
- Loosen Solenoid mounting screws (2x).
- Move solenoid down on bracket to obtain a clearance of 0.010 to 0.015 in. (0.254 to 0.381 mm) between the load plate and the lift extension of the upper-head arm at the location of minimum clearance. Move the carriage through its full travel manually to determine the location of minimum clearance.

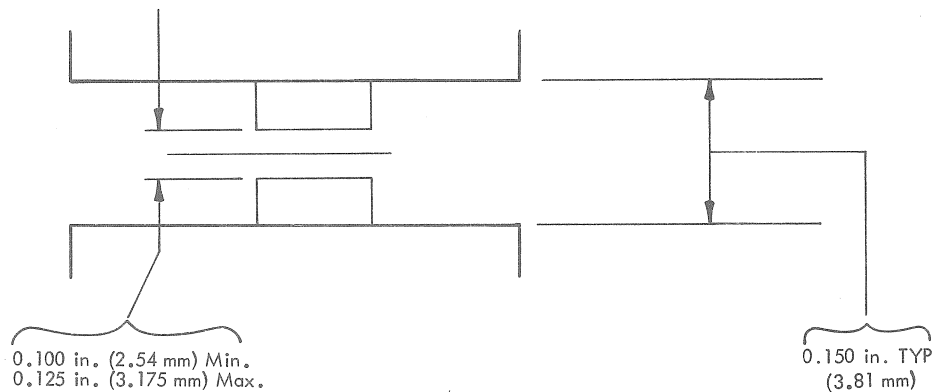


(X267a)

Figure 6-9. Load Pad Adjustment

6.4.7 HEAD-UNLOAD CLEARANCE

Adjust set screw on clamshell for 0.100 in. to 0.125 in. (2.54 to 3.175 mm) clearance per Figure 6-10 between flyer pads with head-load solenoid de-energized and clamshell closed.



(X267c)

Figure 6-10. Head Unload Clearance as Viewed from the Front of the Carriage

CAUTION

Do not use gauge for this adjustment. Estimate spacing by viewing with an inspection mirror.

6.4.8 BAND ALIGNMENT

Referring to Figure 6-12:

- Attach band to carriage.
- Loosen clamp screws on pulley, access through adapter slot.
- Tension band and tighten idler mounting plate.
- Move carriage by hand (full travel) several times to allow band to align.
- Tighten pulley clamp screws.

- f. Move carriage to check band alignment. Check for band kink near carriage mount over full range of carriage traverse.
- g. Repeat procedure to eliminate kinking.
- h. Perform 6.4.2.

CAUTION

Band edge is sharp.

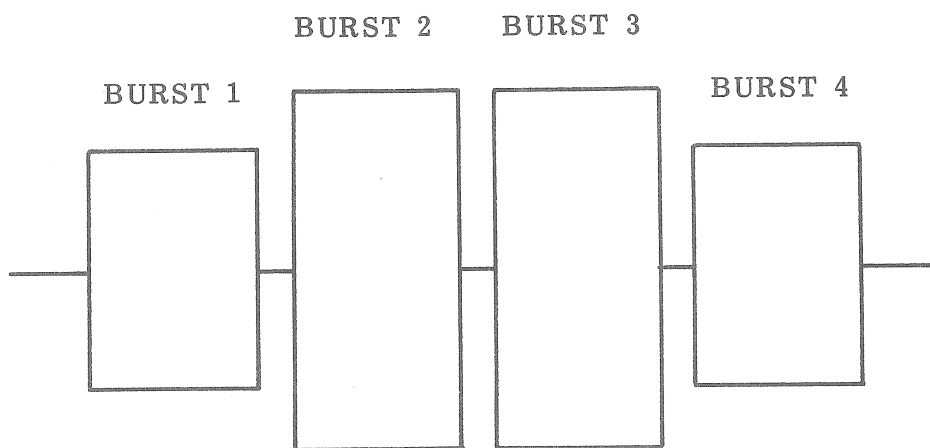
6.4.9 AZIMUTH ADJUSTMENT

Using an alignment diskette, seek to Track 76 and adjust azimuth by turning the azimuth set screw in the guide-rod boss. The set screw should be adjusted in such a way that the azimuth pattern is optimized between head "0" and "1". See Figure 6-10.1 for optimum azimuth alignment.

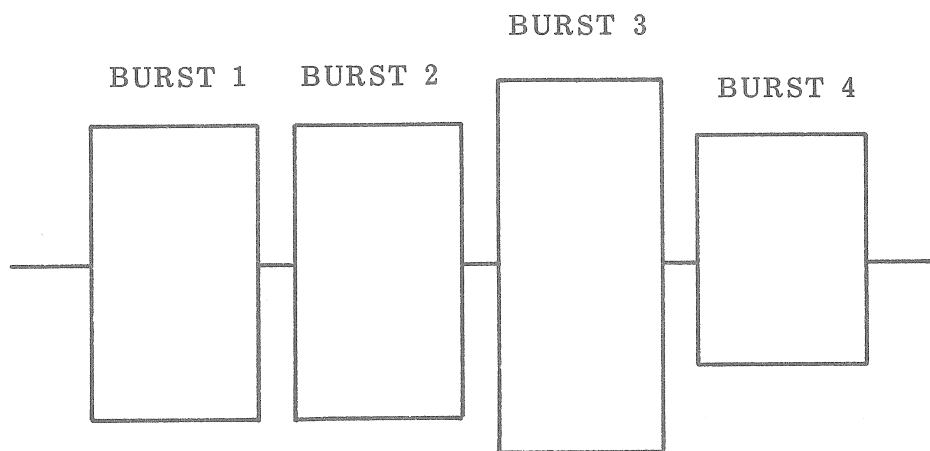
The azimuth of both heads must be less than ± 12 minutes from nominal.

6.5 REMOVAL AND REPLACEMENT PROCEDURES

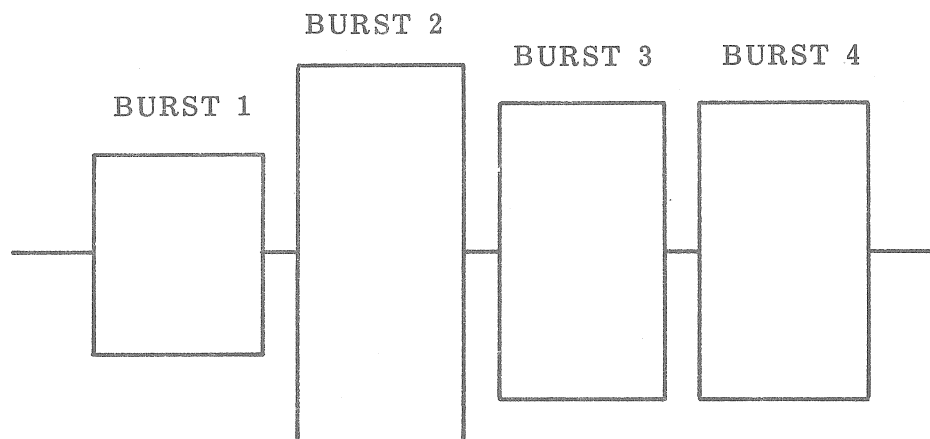
The following procedures give the proper sequence for removal and replacement of major assemblies. To avoid damage to parts, the procedure must be performed in sequence.



Depicts an optimum alignment of zero minutes of azimuth error. Note that bursts 1 and 4 are of equal amplitude, and 2 and 3 are of equal amplitude.



Depicts an alignment of exactly -12 minutes of azimuth error. Note that bursts 1 and 2 are of equal amplitude.



Depicts an alignment of exactly +12 minutes of azimuth error. Note that bursts 3 and 4 are of equal amplitude.

FIGURE 6-10.1. AZIMUTH PATTERNS

6.5.1 PRINTED-CIRCUIT BOARD (PWA)

- a. Disconnect I/O Cable from J1 (refer to Figure 5-3).
- b. Disconnect harnesses from connectors on printed-circuit board.
- c. Remove two screws from printed-circuit board adjacent to connector J1.
- d. Remove PWA by detaching it from the four push-in clips.
- e. To replace printed-circuit board, push clips through printed-circuit board.
- f. Replace two screws adjacent to connector J1.
- g. Reconnect harness and I/O cable.
- h. Set dipswitch S1/S2 if applicable.
- i. Perform 6.4.1.

6.5.2 HEAD REPLACEMENT

Referring to Figures 6-11 and 6-12.

- a. Remove clamshell;
- b. Disconnect head cables;
- c. Loosen tension on idler;
- d. Remove band retainer from carriage;
- e. Remove band from carriage;

CAUTION

Band has sharp edges; don't kink or bend.

- f. Remove cable guide;
- g. Remove cable clamp;
- h. Lift ejector mechanism to remove head cables from channel;
- i. Remove clamp screws from carriage guide bar;
- j. Slide carriage to rear to clear idler assembly and remove. Care must be taken to prevent head assemblies from snapping together.
- k. Remove guide bar from carriage;
- l. Reverse procedure to install new carriage. Care must be taken to get swing-arm lift tab above head-load plate.
- m. Tighten screws on guide rod;
- n. Route cable through ejector channel and install cable wire guide;
- o. Thread cables through chassis and connect to circuit board;
- p. Install cable clamp; go to 6.4.8, Band Alignment, and perform Steps a through h;
- q. Install clamshell;
- r. Perform 6.4.1 through 6.4.9.

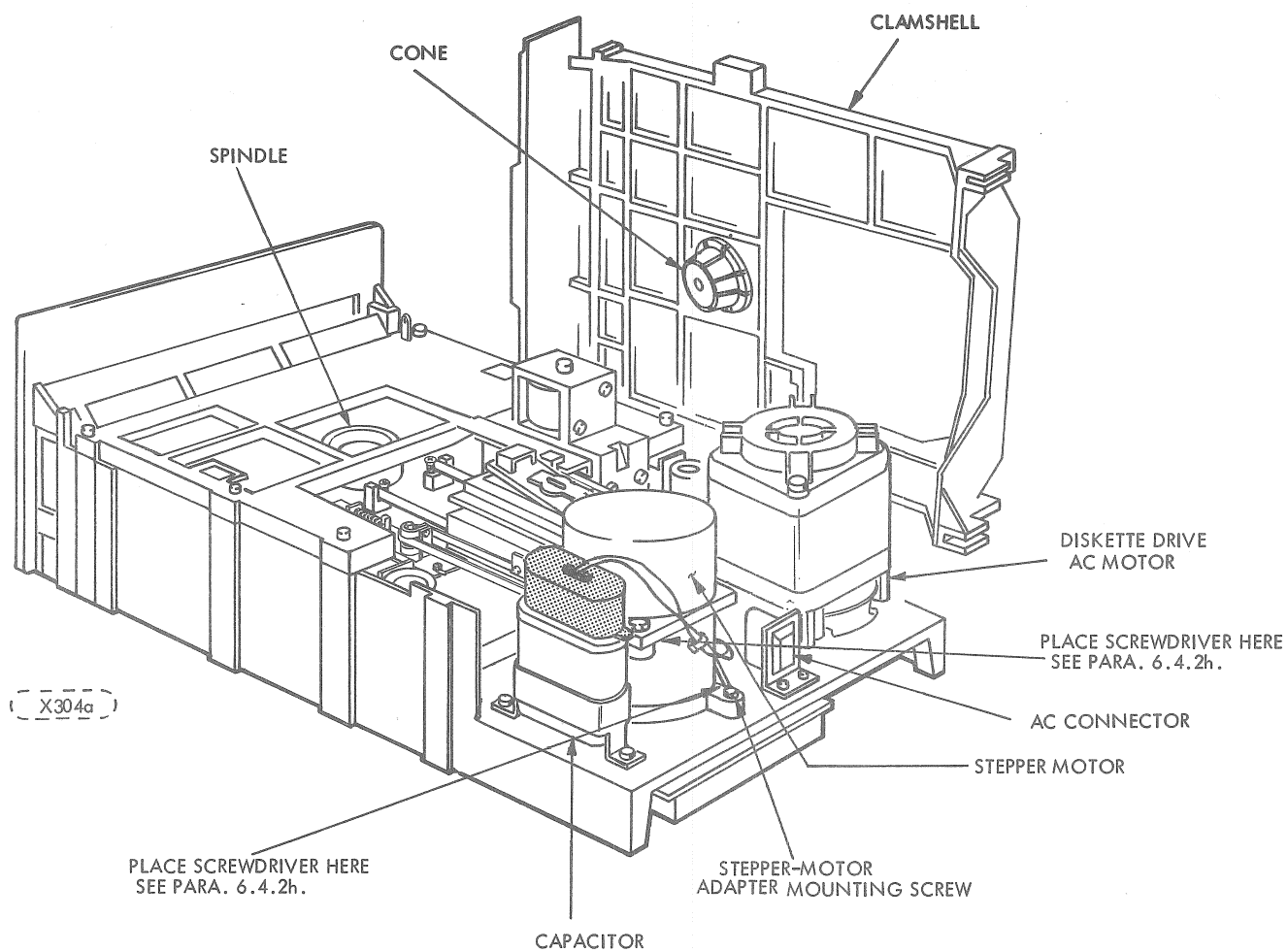
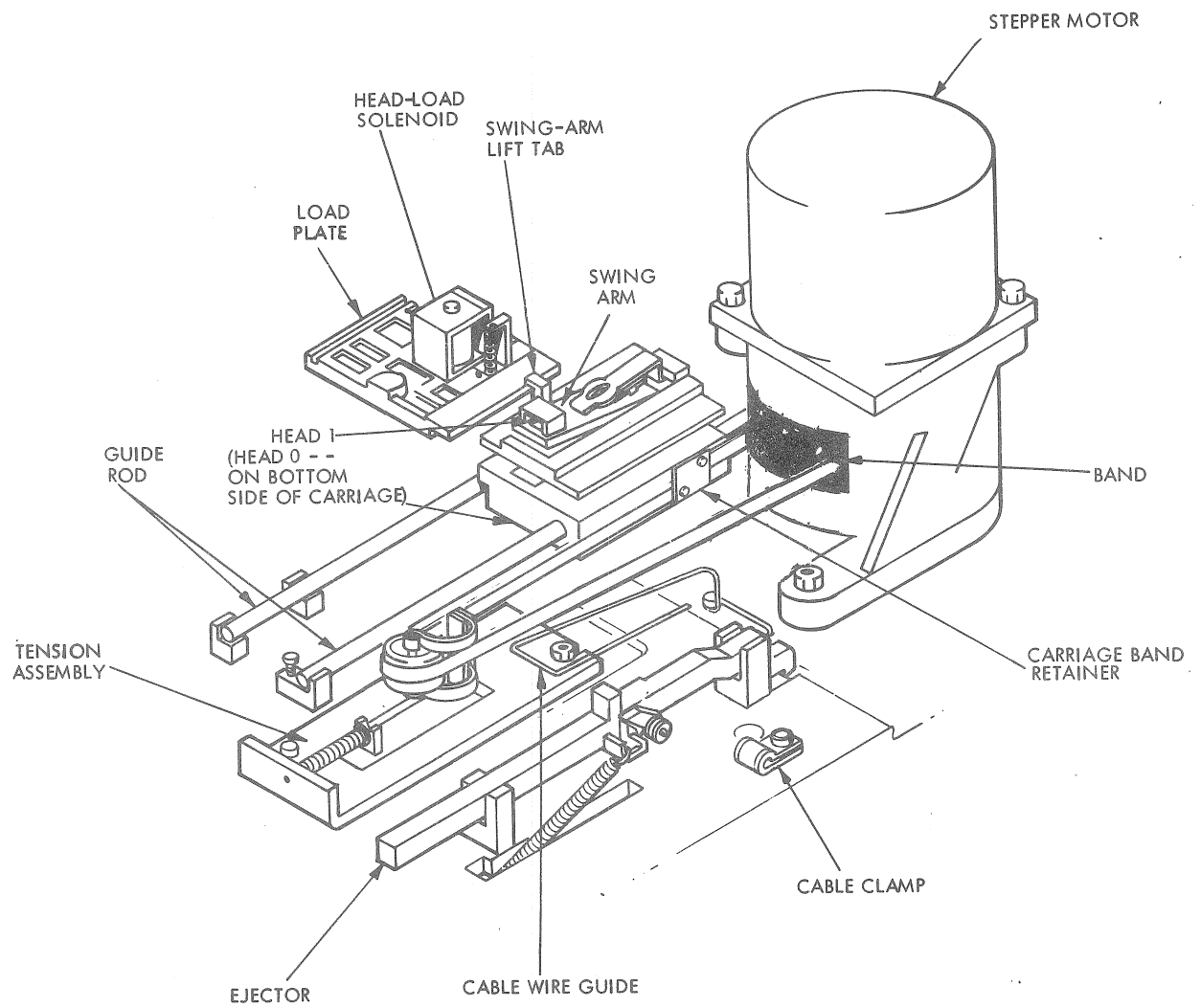


Figure 6-11. Positioning and Head-Load Mechanism, Clamshell Cover Raised.



(X304b)

Figure 6-12. Head-Load Carriage and Stepper Motor Details.

6.5.3 DRIVE MOTOR ASSEMBLY

- a. Perform removal procedure for printed-circuit board (paragraph 6.5.1).
- b. Remove screws securing drive-motor cable clamps.
- c. Remove AC connector from bracket.
- d. Remove spindle drive belt.
- e. Remove three (3) nuts or screws securing drive motor.
- f. Remove drive-motor assembly (drive motor, capacitor, and AC connector).
- g. To replace drive-motor assembly, reverse the above procedure.

6.5.4 ACTUATOR REPLACEMENT

- a. Perform Steps a through e of paragraph 6.5.2
- b. Remove pins J3-04, 03 and 02.
- c. Loosen bottom 2x screws and remove stepper motor and band.
- d. Reverse the above procedure to reassemble stepper motor and band drive to unit.
- e. Perform 6.4.1 through 6.4.8.

6.6 FREQUENCY CONVERSION

6.6.1 OPERATING FREQUENCIES CONVERSION PROCEDURE

This procedure is to be used to convert the FDD unit from 60 Hz operation to 50 Hz operation, or vice versa. This is accomplished by reversing the dual-diameter reversible pulley on the spindle-motor shaft using the following steps:

- a. Remove AC power.
- b. Remove printed-circuit board assembly per paragraph 6.5.1.
- c. Remove the belt from the spindle-motor pulley. (Accessible from the under side of unit.)
- d. Loosen setscrew and remove pulley.
- e. Reverse pulley and replace on motor shaft.

- f. Position pulley allowing tolerance of 0.039 in. (0.99 mm) $\pm$ 0.10 in. (0.254 mm) between shoulder of motor mounting screws and pulley (Figure 6-13).
- g. Tighten down setscrew.
- h. Replace belt and printed-circuit board.

CAUTION

It is **IMPORTANT** that the new operating frequency be marked on the unit's rating nameplate.

NOTE: When converting from 60 Hz to 50 Hz, the same belt may be used. When converting from 50 Hz to 60 Hz a new belt must be installed.

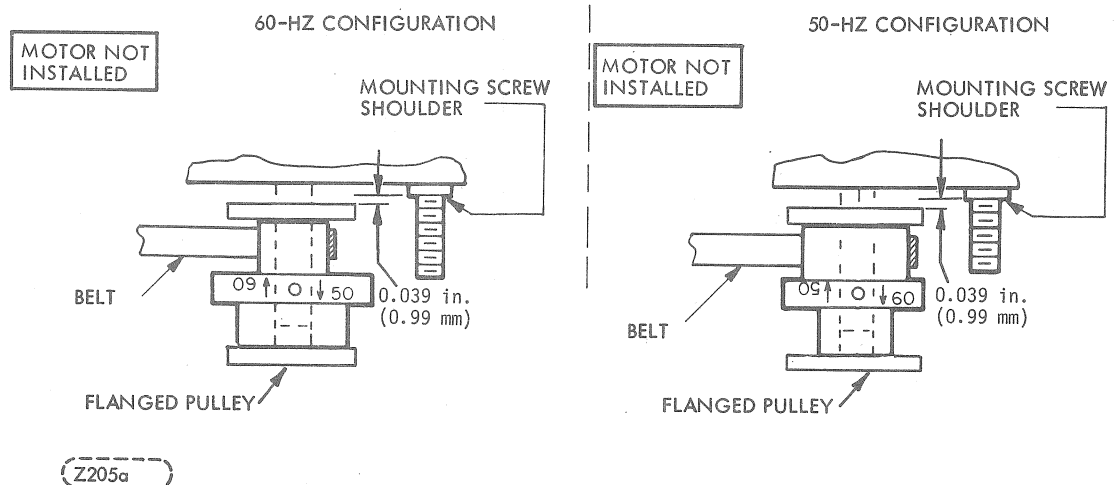


Figure 6-13. Drive-Pulley Reversal

MAINTENANCE AIDS

7.1 INTRODUCTION

This section contains detailed information on the logic circuits used in the FDD. The logic consists of two types of circuits: discrete component and integrated circuits (IC). Integrated circuits are contained within a single chip and discrete component circuits contain individually identifiable resistors, capacitors, transistors, etc.

7.2 PHYSICAL DESCRIPTION (Logic)

All components are mounted on one side of the printed circuit board. The board is 8 x 11 inches (203.2 mm x 279.4 mm) and contain both IC and discrete component circuits.

7.3 USE OF RELATIVE LEVEL INDICATORS

The relative level indicator is a small triangle located on the input or output to a logic block. The presence or absence of this indicator indicates the conditions that are necessary to satisfy the function of the logic block. The presence of the triangle indicates a 0 logic level on that line is needed to satisfy the function. The absence of the triangle indicates a logical 1 is needed to satisfy the function.

The relative level indicator depicts the occurrence of inversion. Figure 7-1 shows some representative examples of the relative level indicator being used in this manner.

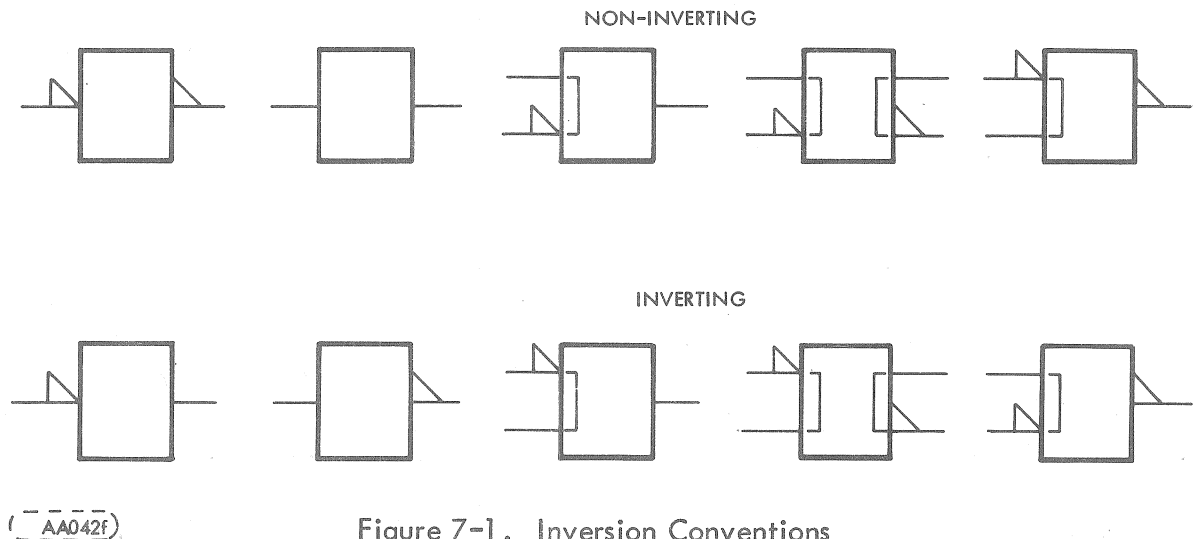


Figure 7-1. Inversion Conventions

7.4 INTEGRATED CIRCUITS

Figure 7-2 shows an example of a schematic block and the information that it contains. The first line gives the function symbol which identifies the logic function that the block performs. Refer to Figure 7-3 for a summary of function symbols. The second line gives the CDC element number. The third line on the schematic block gives the circuit reference designation.

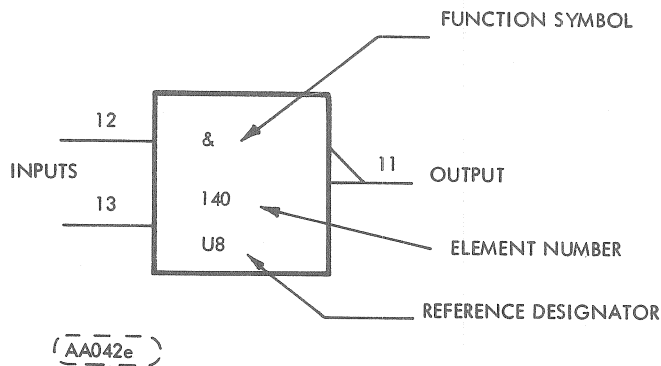


Figure 7-2. Integrated Circuit

FUNCTION SYMBOLS	
&	AND GATE OR INVERTER
1	OR GATE OR INVERTER
=1	EXCLUSIVE OR
1	ONE SHOT
Σ	SUMMING CIRCUIT NUMBER FOLLOWING (EXAMPLE 100) INDICATES GAIN OF 100
X/Y	LEVEL CONVERSION - TRANSMISSION LINE TO LOGIC LEVEL, SWITCH STATE TO LOGIC LEVEL OR LOGIC LEVEL TO POWER OUTPUT
	SCHMITT TRIGGER (LOWER TRIP POINT ADJUSTABLE)
GENERAL SYMBOLS	
	INDICATES NON STANDARD LOGIC LEVEL
	INDICATES ANALOG SIGNAL
	TEST POINTS
	INHIBITING INPUT

(BB151b)

Figure 7-3. Schematic Symbols

PARTS DATA

8.1 INTRODUCTION

This section contains an illustrated parts breakdown that describes and illustrates all variations of the (band-driven) Model 9406 Flexible Disk Drive (FDD). In general, parts are in disassembly sequence but do not necessarily indicate the maximum recommended disassembly of parts in the field.

8.2 ILLUSTRATIONS

Item numbers within a circle (1) indicate an assembly (group of parts). Item numbers without a circle, 1, indicate a single part; a group of parts that are pinned or press fitted together; or a group of parts which is normally replaced as an assembly.

8.3 PARTS LIST

In addition to the accompanying parts list on each illustration, two additional Parts Lists are available; the Top-Down Assembly/Component Parts List and the Cross Reference Index. Instruction for the use of all Parts Lists is given in para. 8.6.

8.4 PRODUCT CONFIGURATIONS

In conjunction with Table 8-1, Figure 8-1 serves two purposes;

1. When used with Table 8-1, it identifies all unique parts and assemblies for each FDD variation.
2. It identifies by sheet location where all major assemblies are broken down.

8.4.1 HARDWARE PRODUCT CONFIGURATOR (HPC)

To determine what parts are used on a particular model, find the applicable HPC number in Table 8-1. The item numbers at the top of Table 8-1 corresponds with the item numbers in Figure 8-1. All parts and assemblies that apply to the HPC number will be identified with an 'X' ('0' means not applicable). NOTE: The HPC Number is identical to the Equip. Ident. No. shown on the label.

8.5 REPLACEMENT PARTS

When ordering replacement parts for the FDD, the inclusion of the following information for each part ordered will ensure positive identification:

1. Equip. Ident. No
2. Publication Number 75888344
3. Figure and Item Number
4. Identification Number and Description

NOTE:
Before ordering parts however, refer to paragraph 8.5.1 Spare Parts.

8.5.1 SPARE PARTS

This Illustrated Parts Breakdown is complete to the extent that all parts and assemblies are depicted and identified. Replacement part availability depends on the materials and provisioning operation of the supplier.

To assist the service representative in selecting replacement parts with minimum requisitioning lead times, engineering recommended spare parts which reflect the intended service level of the device are identified with the letters SP adjacent to the item number on the face of each illustration. Replaceable non-spared items will require longer requisitioning lead times.

TABLE 8-1. PRODUCT CONFIGURATION

HPC	ITEM NUMBERS							
	3333333333	3333333333	3444444444	4444444444	4444444444	4444444444	4444444444	4444444444
	0000000001	5555555555	9000000000	0111111111	2222222222	3333333333	4455667777	
	1234567890	0123456789	9012345678	9012345678	0123456789	0123456789	0101010123	
77618000	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	X000000000	X0X0X00000	
77618001	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	X000000000	X0X0X00000	
77618002	00X00000X0	00X0000000	0XX0000000	0X00000000	X000000000	X000000000	00X0X00000	
77618003	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	X000000000	0X00000000	
77618004	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X00000	
77618005	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X00000	
77618006	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	X000000000	X0X0X00000	
77618007	00X00000X0	000X000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618008	00X00000X0	000X000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618009	00X00000X0	0000X00000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618010	00X00000X0	0000X00000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618011	00X00000X0	000X000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618012	00X00000X0	000X000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618013	00X00000X0	0000X00000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618014	00X00000X0	0000X00000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X0X000	
77618015	00X00000X0	00X0000000	0XX0000000	0X00000000	X000000000	X000000000	X0X0X00000	
77618016	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	X000000000	X0X0X00000	
77618017	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	00X0000000	X0X0X00000	
77618018	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	X000000000	00X0X00000	
77618019	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X00000	
77618020	00X00000X0	000X000000	X00X000000	00X000X000	0X00000000	000000X000	X0X0X0X000	
77618021	00X00000X0	0000X00000	X00X000000	00X000X000	0X00000000	000000X000	X0X0X0X000	
77618022	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	000000X000	X0X0X0X0X0	
77618023	00X00000X0	0000X00000	X00X000000	000X00X000	0X00000000	000000X000	X0X0X0X0X0	
77618024	00X00000X0	000X000000	X00X000000	00X000X000	0X00000000	000000X000	X0X0X00X00	
77618025	00X00000X0	0000X00000	X00X000000	00X000X000	0X00000000	000000X000	X0X0X00X00	
77618026	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	000000X000	X0X0X00X00	
77618027	00X00000X0	0000X00000	X00X000000	000X00X000	0X00000000	000000X000	X0X0X000X0	
77618028	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	X000000000	X0X0X00000	
77618029	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X00000	
77618030	00X00000X0	000X000000	0XX0000000	0X00000000	X000000000	000X000000	X0X0X00000	
77618031	00X00000X0	0000X00000	0XX0000000	0X00000000	X000000000	000X000000	X0X0X00000	
77618032	00X00000X0	0000X00000	0XX0000000	0X00000000	X000000000	000X000000	X0X0X00000	
77618033	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X00000	
77618034	00X00000X0	000X000000	000X000000	0000X0X000	00X0000000	00000X0000	X0X0X000X0	
77618035	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X0X0X0	
77618036	00X00000X0	0000X00000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X0X0X0	
77618037	00X00000X0	0000X00000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X0X0X0	
77618038	00X00000X0	0000X00000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618039	00X00000X0	X000000000	00X00X0000	00000X0000	000X000000	0X00000000	X0X0X00000	
77618040	00X00000X0	0X00000000	00X00X0000	00000X0000	000X000000	0X00000000	X0X0X00000	
77618041	00X00000X0	0X00000000	00X00X0000	00000X0000	000X000000	0X00000000	X0X0X00000	
77618042	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X0X0X0	
77618043	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618044	00X00000X0	00000X0000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618045	00X00000X0	0000X00000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618046	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618047	00X00000X0	00000X0000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618048	00X00000X0	000X000000	X00X000000	000X00X000	0X00000000	00000X0000	X0X0X000X0	
77618049	00X00000X0	X000000000	0XX0000000	0X00000000	X000000000	00X0000000	X0X0X00000	
77618050	00X00000X0	000000X000	X00X000000	000X00X000	0X00000000	000000X000	X0X0X0X0XC	
77618051	00X00000X0	0X00000000	00X000X000	X000000000	0000X00000	0X00000000	X0X0X00000	
77618052	00X00000X0	000X000000	0XX0000000	0X00000000	X000000000	0X00000000	X0X0X00X00	
77618053	00X00000X0	0X00000000	0XX0000000	0X00000000	X000000000	00X0000000	X0X0X00000	

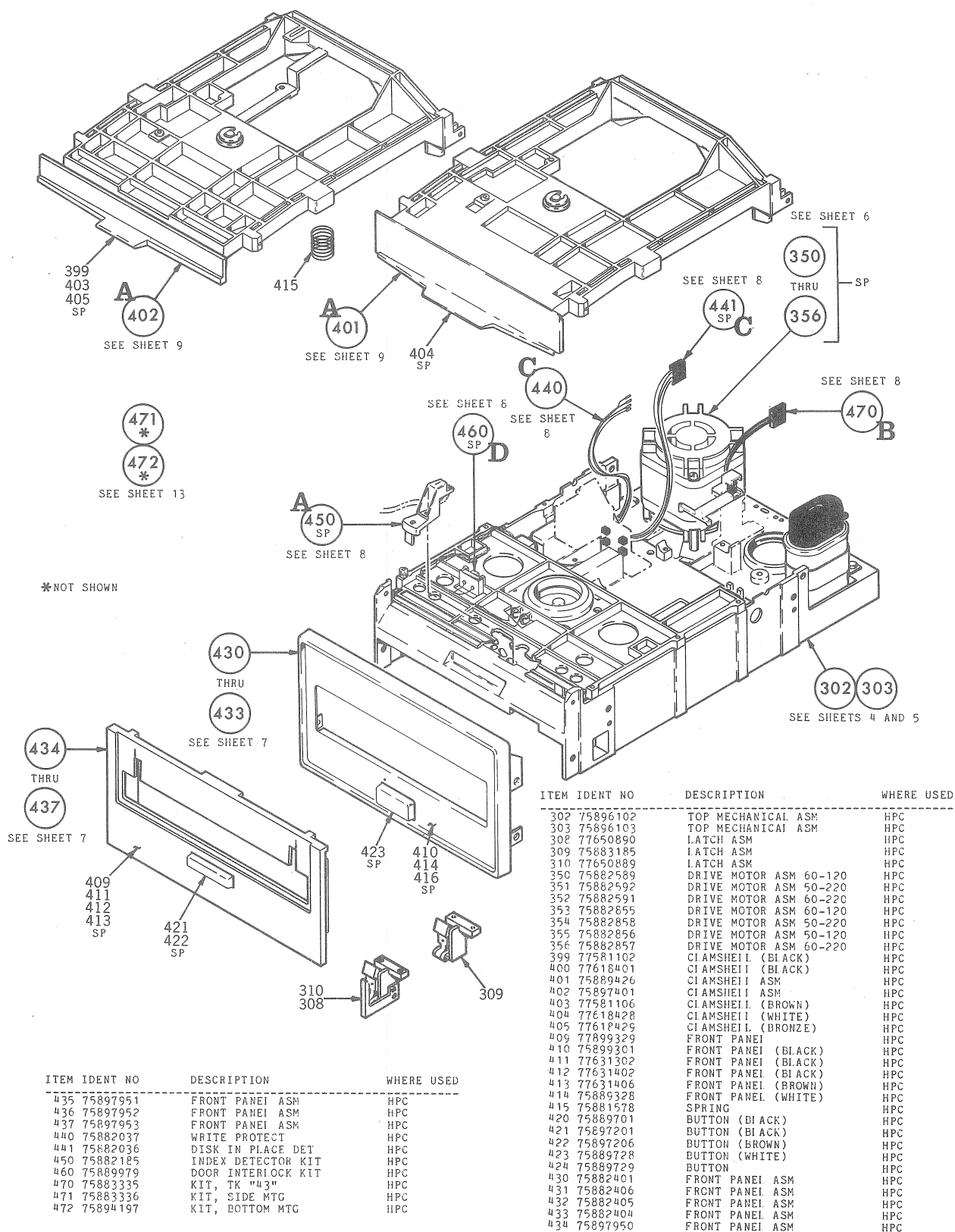


TABLE 8-1. PRODUCT CONFIGURATION

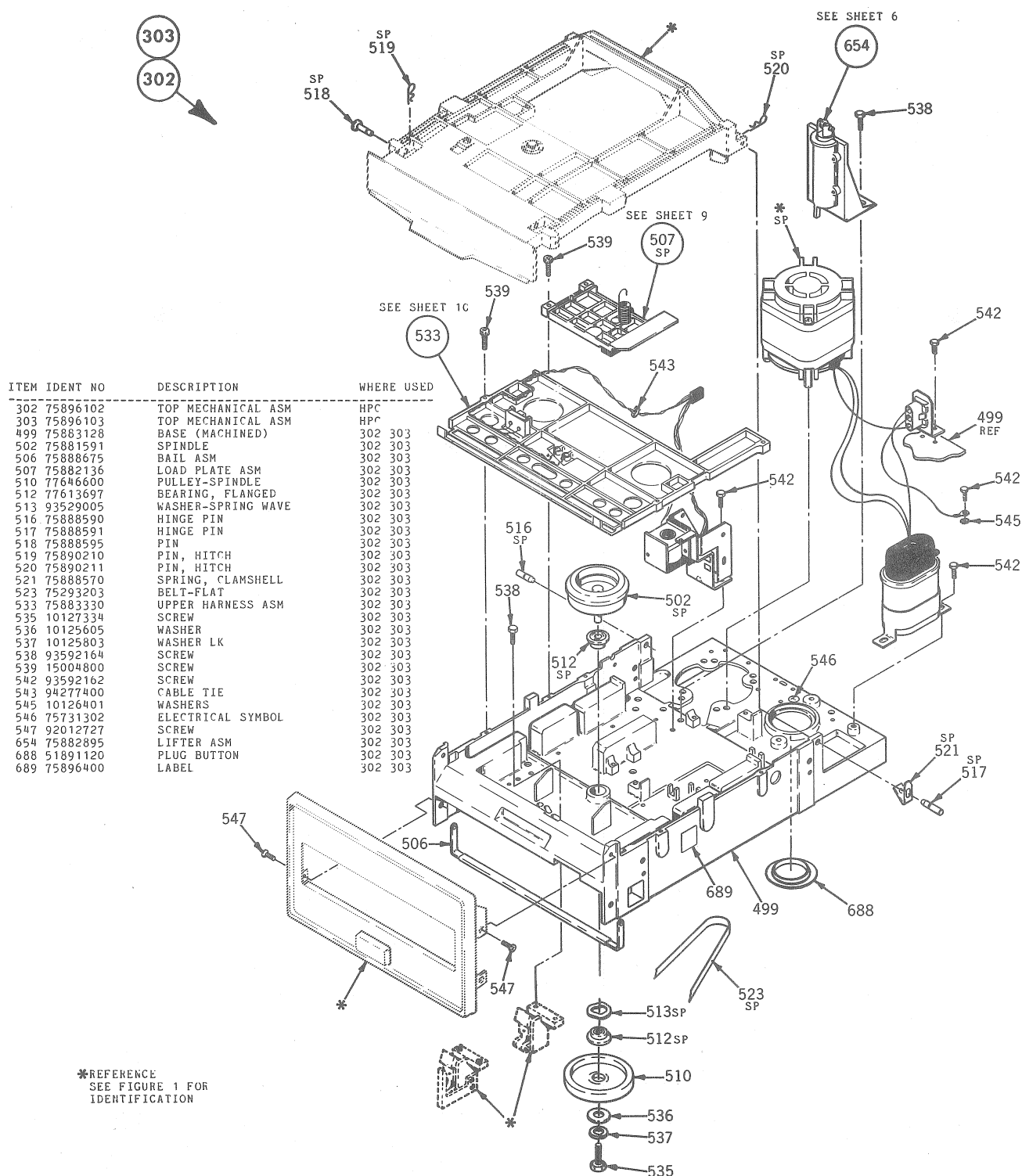
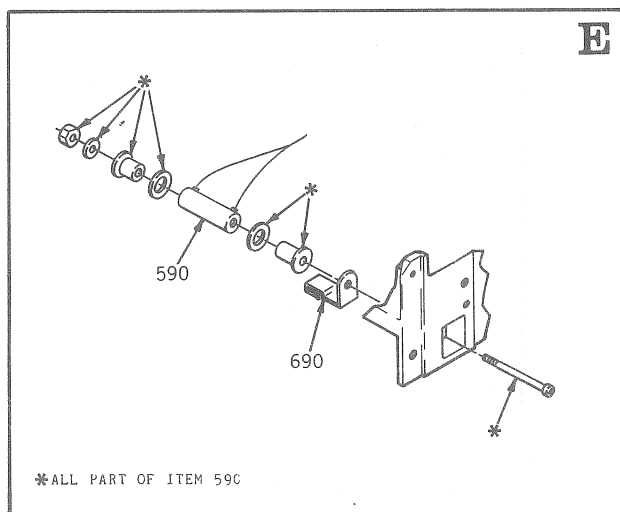
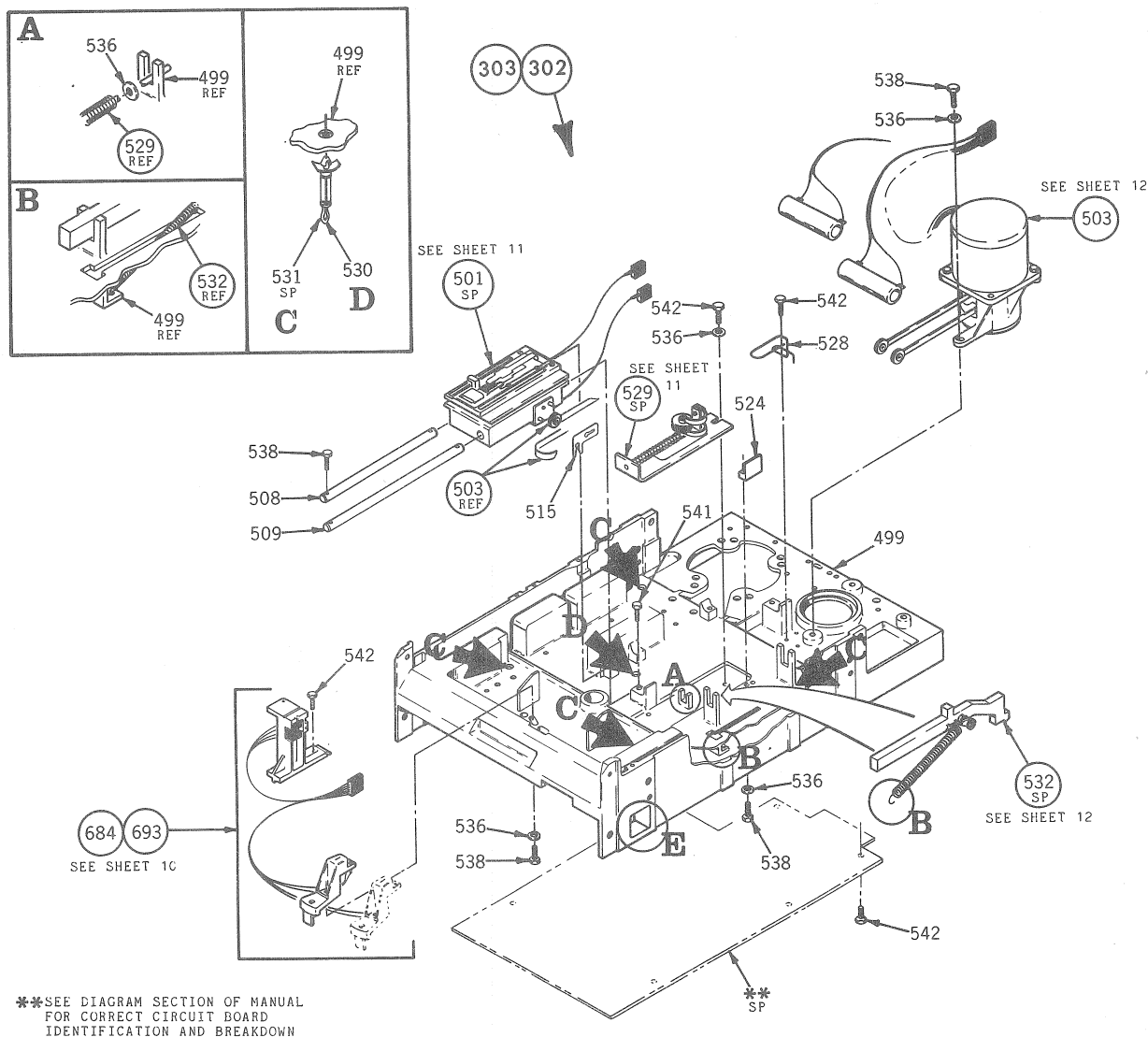
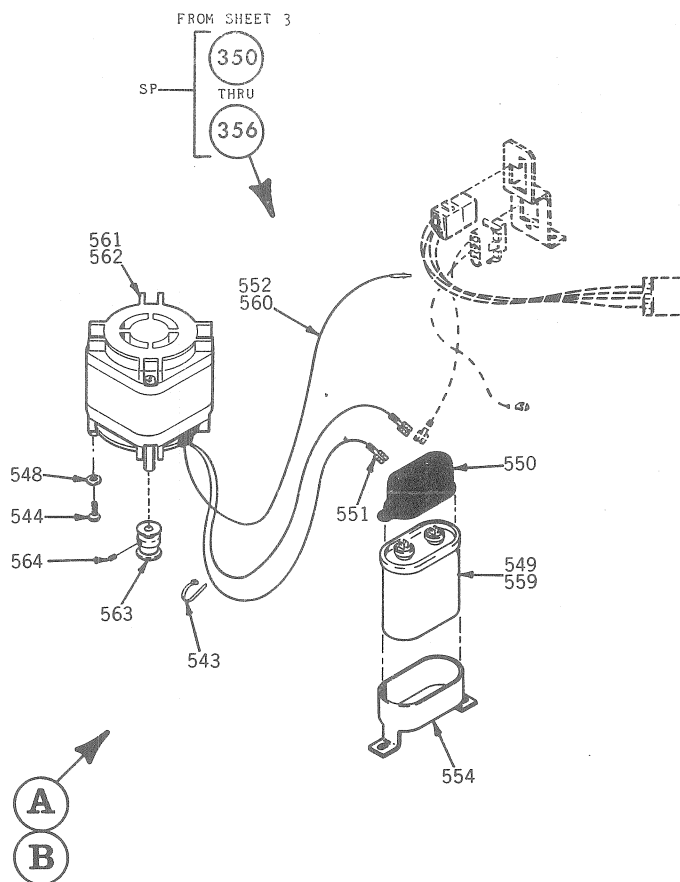
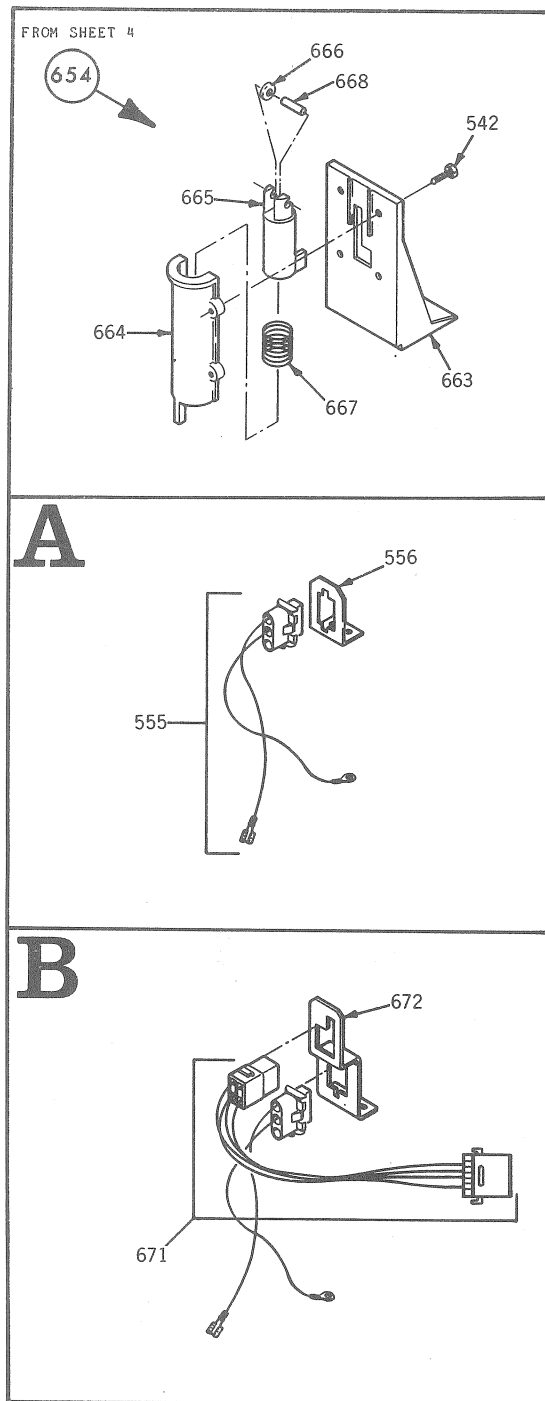


FIGURE 8-2. TOP MECHANICAL ASSEMBLY (Sheet 1 of 2)



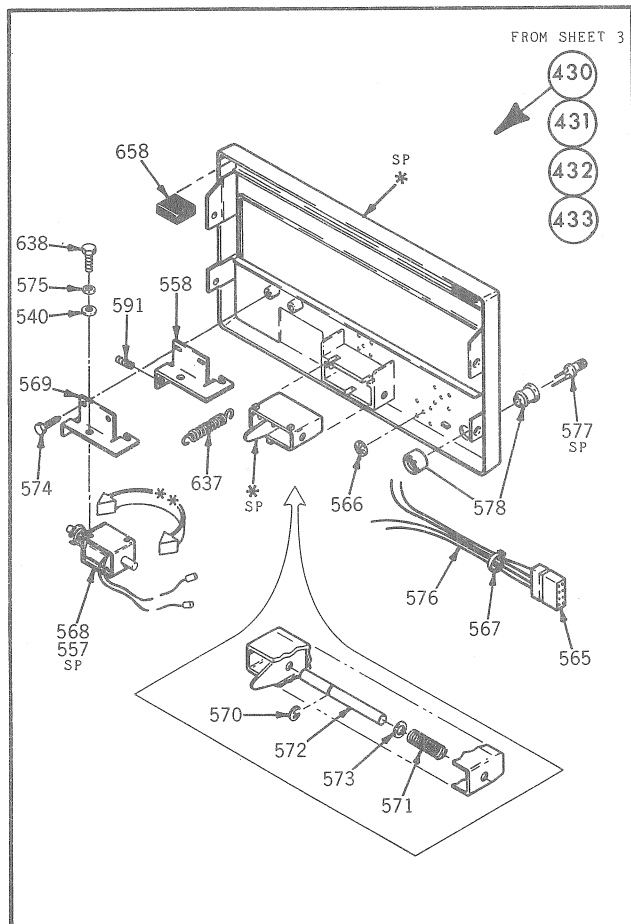
ITEM ID/IT NO	DESCRIPTION	WHERE USED
302 75896102	TOP MECHANICAL ASM	HPC
303 75896103	TOP MECHANICAL ASM	HPC
499 75883128	BASE (MACHINED)	302 303
501 75896122	CARRIAGE ASSEMBLY	302 303
503 75892007	ACTUATOR ASSEMBLY	302 303
508 75881326	GUIDE CARRIAGE	302 303
509 75881275	GUIDE ROD	302 303
515 75883017	RETAINER	302 303
524 75883240	LATCH BLOCK	302 303
528 75883095	GUARD, HEAD CABLE	302 303
529 75883215	TENSION ASSEMBLY	302 303
530 75774732	CLIP-PUSH IN	302 303
531 75774736	CLIP-PUSH IN	302 303
532 75889396	EJECTOR ASM	302 303
534 09023703	SCREW	302 303
536 10125605	WASHER	302 303
538 93592164	SCREW	302 303
541 18862916	SCREW	302 303
542 93592162	SCREW	302 303
624 10126101	LOCK WASHER	302 303
684 75882177	LOWER HARNESS ASM	302
690 75897601	CABLE GUARD	302 303
693 77641315	LOWER HARNESS ASM	303

FIGURE 8-2. TOP MECHANICAL ASSEMBLY (Sheet 2 of 2)



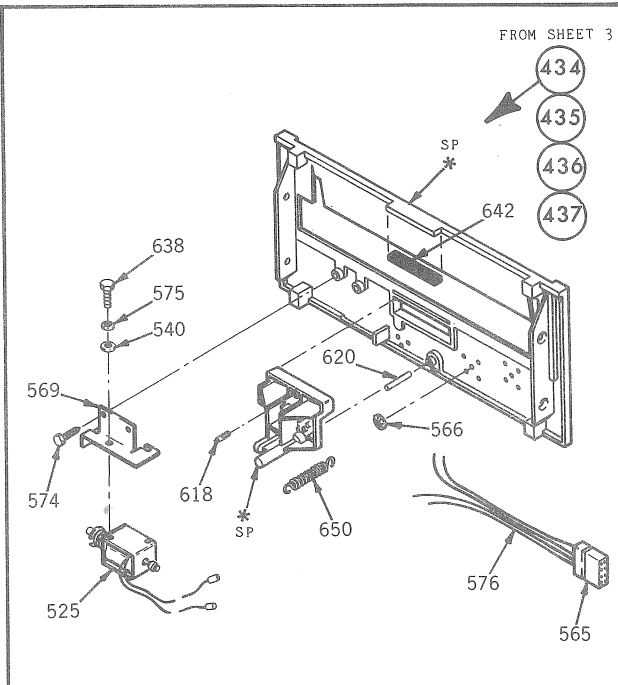
ITEM	IDENT NO	DESCRIPTION	WHERE USED
350	75882589	DRIVE MOTOR ASM 60-120	HPC
351	75882592	DRIVE MOTOR ASM 50-220	HPC
352	75882591	DRIVE MOTOR ASM 60-220	HPC
353	75882855	DRIVE MOTOR ASM 60-120	HPC
354	75882858	DRIVE MOTOR ASM 50-220	HPC
355	75882856	DRIVE MOTOR ASM 50-120	HPC
356	75882857	DRIVE MOTOR ASM 60-220	HPC
542	93592162	SCREW	654
543	94277400	CABLE TIE	350-356
544	93592202	SCREW	350-356
548	10126104	WASHER	350-356
549	75738402	CAPACITOR	350 353
549	75738402	CAPACITOR	355
551	62121108	TERMINAL	350-356
552	83435504	CONTACT	353
554	16439600	MOUNTING BRKT	350-356
555	75882341	CABLE	350-352
556	75882490	BRACKET	350-352
559	75738420	CAPACITOR	351 352
559	75738420	CAPACITOR	354 356
560	83435501	CONTACT	350-352
560	83435501	CONTACT	354-356
561	75726925	MOTOR	350 353
561	75726925	MOTOR	355
562	75726924	MOTOR	351 352
562	75726924	MOTOR	354 356
563	75896006	PULLEY-DUAL DR	350-356
564	83413405	SCREW	350-356
654	75882895	LIFTER ASM	302 303
663	75882740	COVER	654
664	75882735	CYLINDER	654
665	77658915	PISTON	654
666	75882725	ROLLER	654
667	77658910	SPRING	654
668	92021009	PIN	654
671	75883023	CABLE	355
671	75883023	CABLE	353 354
672	75882890	BRACKET	355
672	75882890	BRACKET	353 354

FIGURE 8-3. DRIVE MOTOR AND LIFTER ASSEMBLIES



* REFERENCE
SEE FIGURE 1
FOR INFORMATION

** SHOWN IN LOCK WITH POWER ON
POSITION. ROTATE 180° FOR LOCK
WITH POWER OFF POSITION.



ITEM	IDENT NO	DESCRIPTION	WHERE USED
430	758824C1	FRONT PANEL ASM	HPC
431	758824C6	FRONT PANEL ASM	HPC
432	758824C5	FRONT PANEL ASM	HPC
433	758824C4	FRONT PANEL ASM	HPC
434	7589795C	FRONT PANEL ASM	HPC
435	75897951	FRONT PANEL ASM	HPC
436	75897952	FRONT PANEL ASM	HPC
437	75897953	FRONT PANEL ASM	HPC
525	75882331	SOLENOID ASM	434-435
540	758C65C2	WASHER	432-435
557	75882332	SOLENOID ASM	432
558	77636695	SOLENOID MOUNT	432
565	75293954	HOUSING	431-437
566	CC8482C1	RET RING	431-437
567	942774CC	CABLE TIE	431-433
568	7588233C	SOLENOID ASM	433
569	7763296C	SOLENOID MOUNT	433-435
570	758886CC	SHAFT LOCK	432-433
571	75882C35	SPRING	432-433
572	92C33147	RET RING	432-433
573	758821C7	WASHER	432-433
574	94376917	SCREW	432-435
575	1C1258C1	WASHER	432-435
576	75882335	CABLE	431-437
577	7581C7C1	LED	431-433
578	7581C7C3	RET RING	431-433
591	9382C166	SET SCREW	432
618	77612981	LIGHT EMITTING DIODE	434-437
620	7761CC3C	DOWEL PIN	434-437
637	75899167	SPRING	43C-433
638	1C1271C2	SCREW	432-435
642	776468C4	BUMPER	434-437
650	75899166	SPRING	434-437
658	75883338	BUMPER	431-433

FIGURE 8-4. FRONT PANEL ASSEMBLY

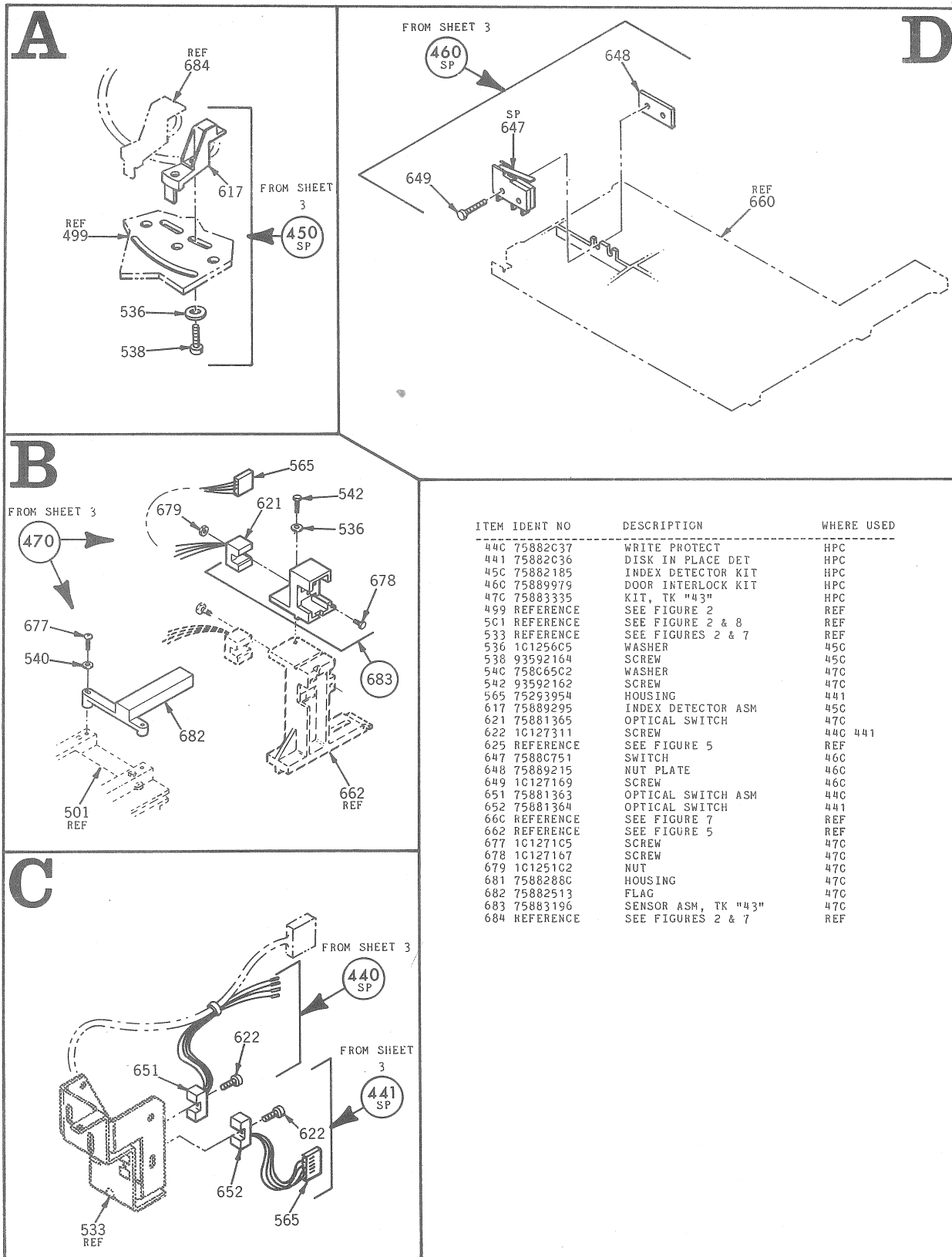
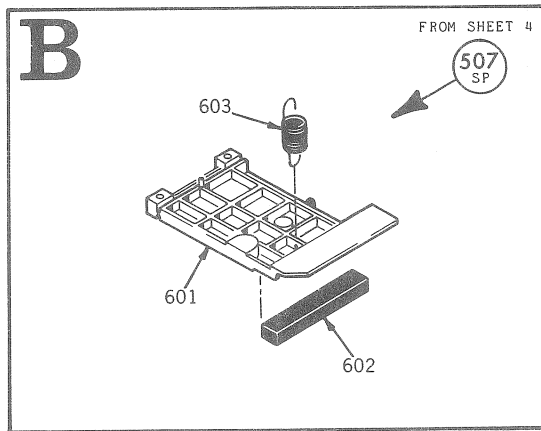
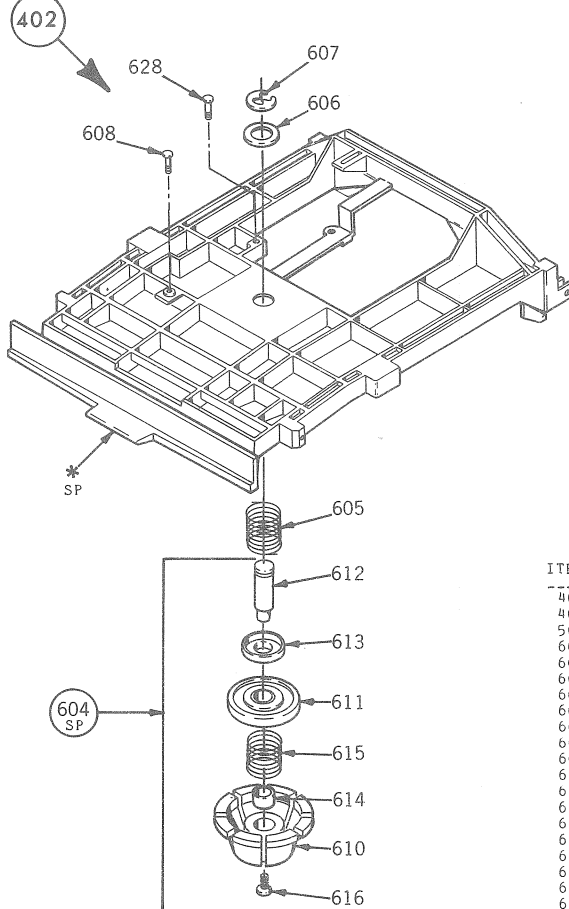


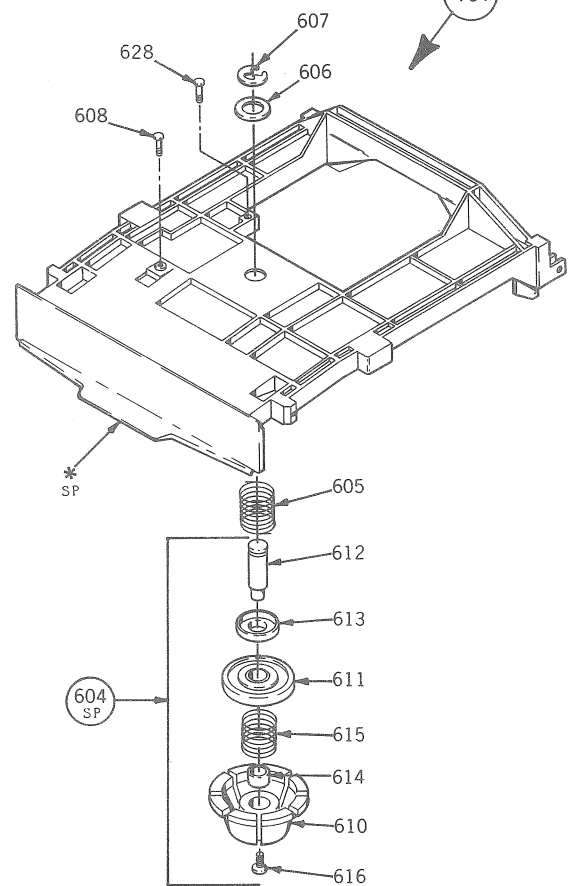
FIGURE 8-5. FEATURE KITS



A FROM SHEET 3



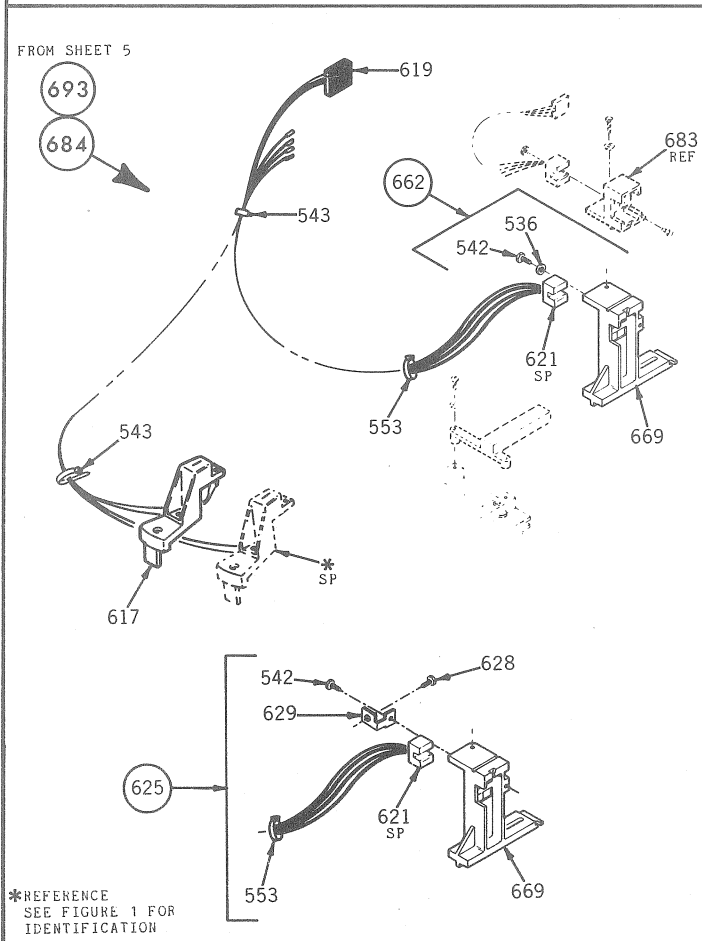
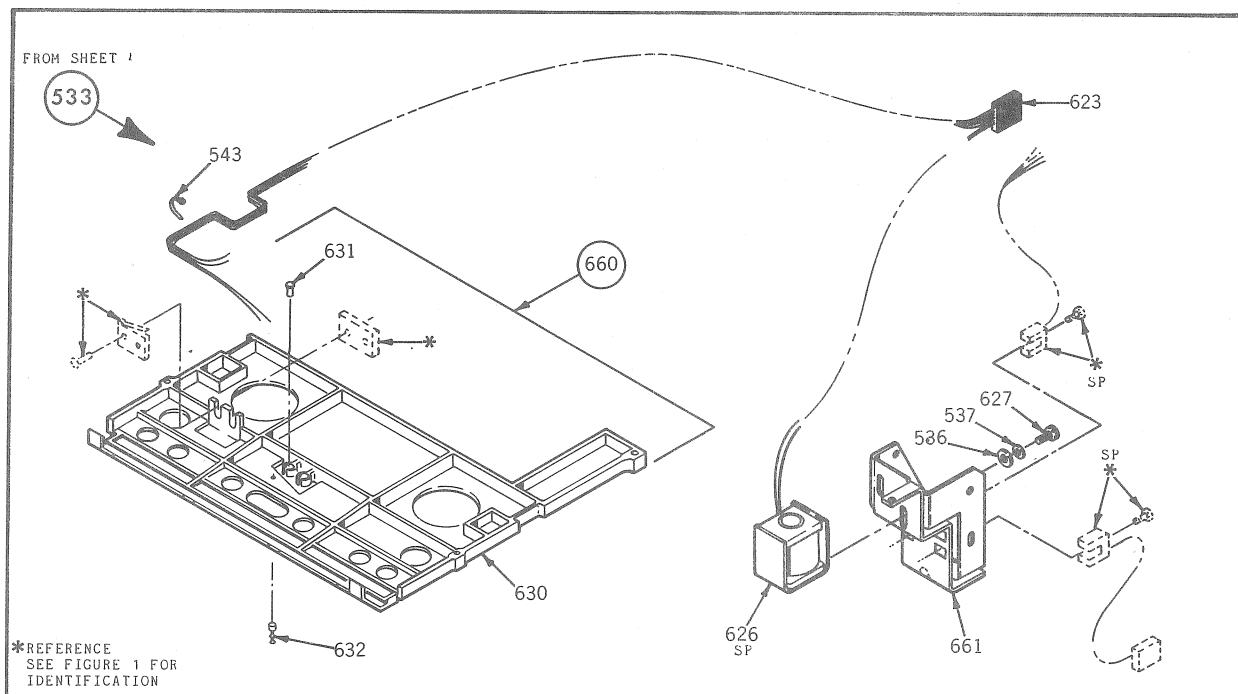
A FROM SHEET 3



ITEM IDENT NO	DESCRIPTION	WHERE USED
4C1 75889426	CLAMSHELL ASM	HPC
4C2 758974C1	CLAMSHELL ASM	HPC
5C7 75882136	LOAD PLATE ASM	3C2 3C3
6C1 7588865C	LOAD PLATE	5C7
6C2 75882C38	FOAM	507
6C3 75882348	SPRING	5C7
6C4 75881895	CONE ASM	4C1 4C2
6C5 75882C17	COMPRESSION SPRING	4C1 4C2
6C6 93564C57	WASHER	4C1 4C2
6C7 92C33C87	RET RING	4C1 4C2
6C8 9382C782	SCREW	4C1 4C2
61C 75881715	CONE	6C4
611 75881892	BEARING	6C4
612 758886C7	SHAFT	6C4
613 7588861C	RETAINER	6C4
614 7588171C	SPACER	6C4
615 75882C16	COMPRESSION SPRING	6C4
616 7761C637	SCREW	6C4
615 75882C16	COMPRESSION SPRING	6C4
616 7761C637	SCREW	6C4
628 9382C248	SET SCREW	4C1 4C2

*REFERENCE
SEE FIGURE 1
FOR IDENTIFICATION

FIGURE 8-6. CLAMSHELL AND LOAD PLATE ASSEMBLIES



ITEM	IDENT NO	DESCRIPTION	WHERE USED
533	75883330	UPPER HARNESS ASM	302 303
536	1C1256C5	WASHER	533
537	1C1258C3	WASHER LK	533
542	93592162	SCREW	662 625
543	942774CC	CABLE TIE	684 693
543	942774CC	CABLE TIE	533
553	77612C11	CABLE TIE	684 693
617	75889295	INDEX DETECTOR ASM	684 693
619	75882145	LOWER CABLE	684 693
621	75881365	OPTICAL SWITCH	662 625
623	7588217C	UPPER CABLE	66C
625	77622495	"C" TRACK ASM	693
626	75882327	SOLENOID	533
627	1C126217	SCREW	533
628	9382C248	SCREW	625
629	776463C9	"C" TRACK STOP	625
630	7588318C	UPPER GUIDE	66C
631	7572CCC1	PHOTO SENSE	66C
632	92498C24	TERMINAL	66C
660	75883C75	UPPER GUIDE ASM	533
661	75888696	BRACKET	533
662	758628R5	"C" TRACK ASM	684
669	75883165	MOUNT	662 625
683	REFERENCE	SEE FIGURE 5	REF
684	75882177	LOWER HARNESS ASM	302
693	77641815	LOWER HARNESS ASM	303

FIGURE 8-7. HARNESS ASSEMBLIES

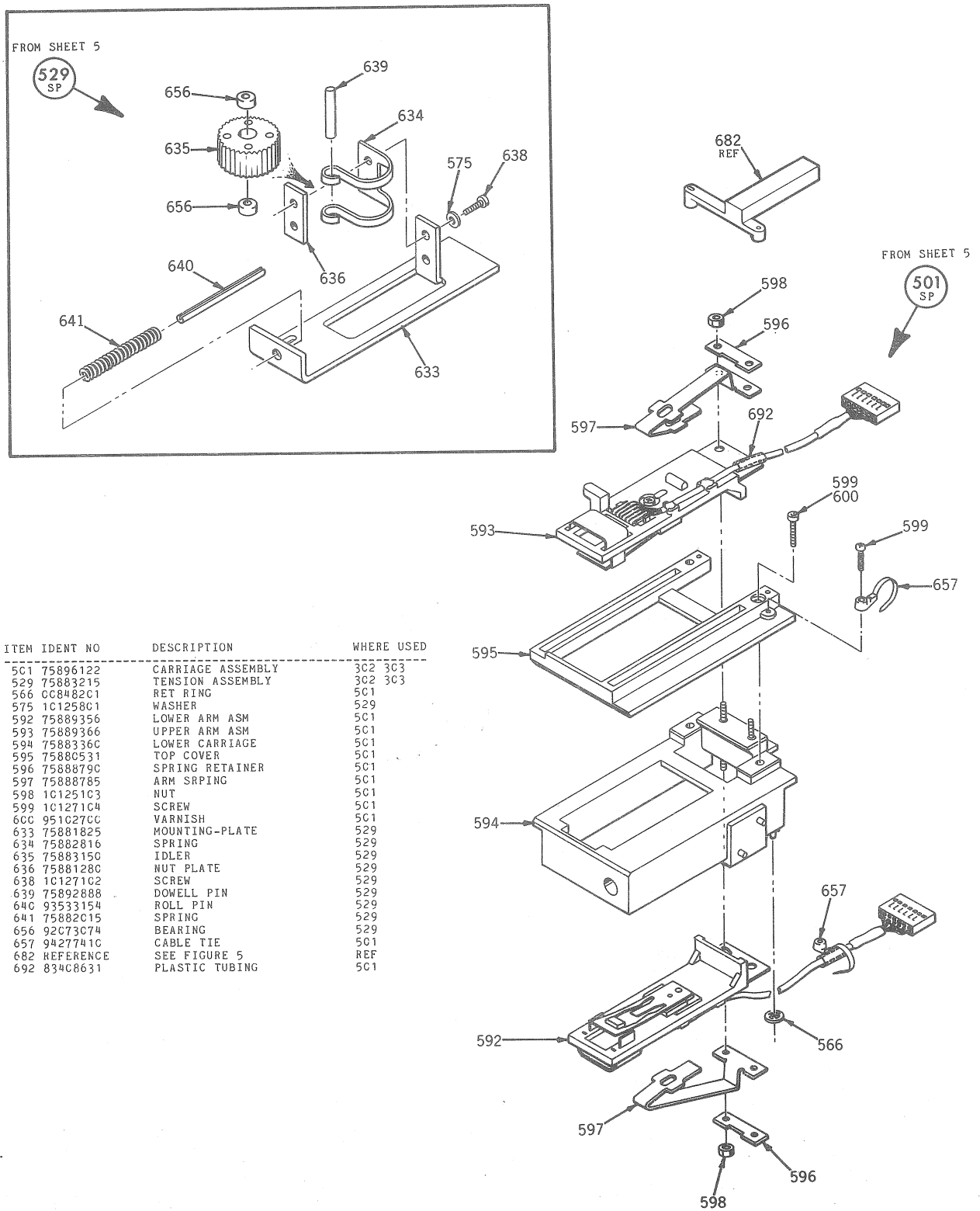
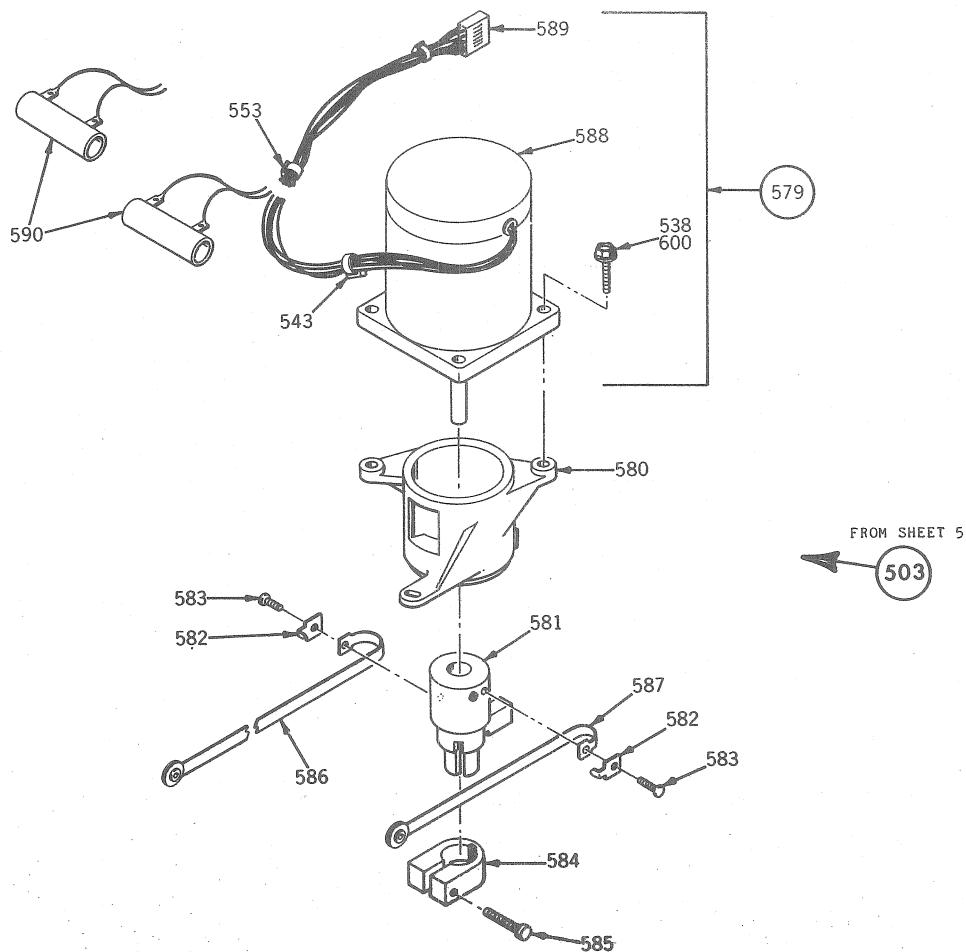


FIGURE 8-8. CARRIAGE AND TENSION ASSEMBLIES



ITEM IDENT NO	DESCRIPTION	WHERE USED
503 75892007	ACTUATOR ASSEMBLY	302 303
532 75889396	EJECTOR ASM	302 303
538 93592164	SCREW	503
543 94277400	CABLE TIE	579
553 77612011	CABLE TIE	579
566 00848201	RET RING	532
566 00848201	RET RING	532
579 75881932	STEPPER MOTOR ASM	503
580 75881563	MOTOR ADAPTER	503
581 75881441	PULLEY	503
582 75881785	BAND RETAINER	503
583 75882026	SCREW	503
584 75881287	CLAMP	503
585 18862716	SCREW	503
586 75883120	BAND	503
587 75883121	BAND	503
588 75882150	STEPPER MOTOR	579
589 75883312	RESISTOR CABLE	579
590 77612491	RESISTOR	579
600 95102700	VARNISH	503
643 75890856	LATCH	532
644 75893550	SPRING	532
646 75881575	SPRING	532
659 75893269	EJECTOR	532

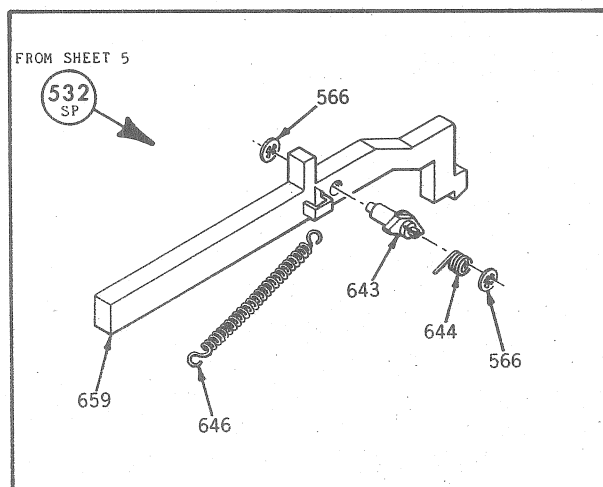
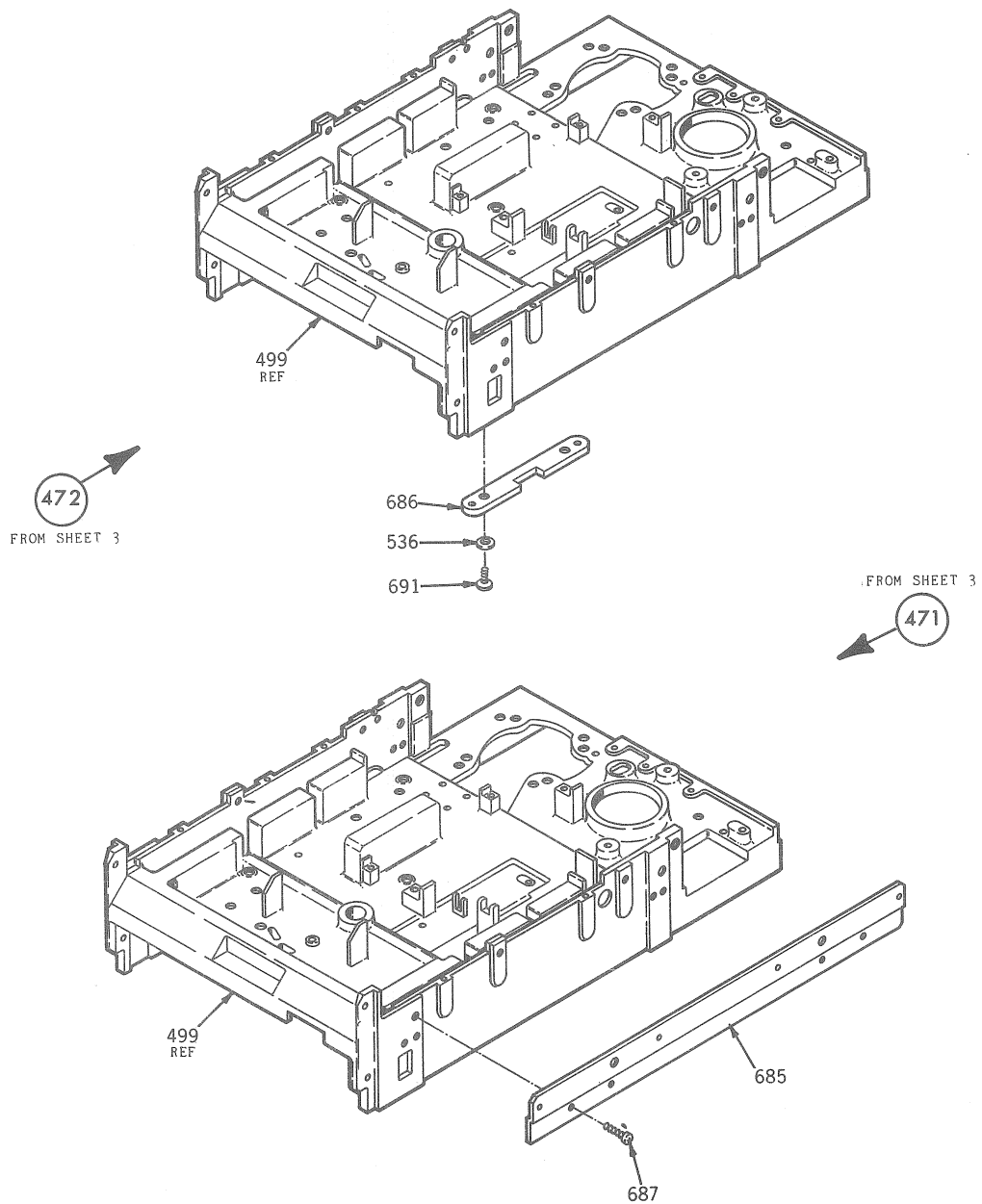


FIGURE 8-9. ACTUATOR AND EJECTOR ASSEMBLIES



ITEM IDENT NO	DESCRIPTION	WHERE USED
471 75883336	KIT, SIDE MTG	HPC
472 75894197	KIT, BOTTOM MTG	HPC
499 REFERENCE	SEE FIGURE 2	REF
536 10125605	WASHER	472
685 10127122	SCREW	471
686 75881607	ADAPTER	472
687 75883001	ADAPTER	471
691 18862716	SCREW	472

FIGURE 8-10. FEATURE KITS

8.6 PARTS LIST INSTRUCTIONS

8.6.1 ILLUSTRATION PARTS LISTS

The parts list for each illustration is an extract from the Top-Down Assembly/Component Parts list and contains only those parts depicted. Refer to paragraph 8.6.2 for explanation of parts list.

8.6.2 TOP-DOWN ASSEMBLY/COMPONENT PARTS LIST

- a. Starts at HPC level and lists all parts in Item Number sequence.
- b. Correlates Item numbers with part Identification numbers and the Description of each.
- c. Identifies where each part is used (where used column) within the device by listing the item number(s) of the next higher assembly.

NOTE

Items 300 through 499 will carry "HPC" in the "Where Used" column. Items shown for reference only will carry "REF."

- d. Defines the location of each part by listing the sheet number(s) where depicted.

NOTE

The same part may be used in any number of assemblies or sheet locations.

8.6.3 CROSS REFERENCE INDEX

- a. Lists all parts in numeric sequence (by Identification Number).
- b. In conjunction with the referenced sheet number (third column) and illustrations, defines the physical location of each item identified.

8.6.4 SHEET NUMBER REFERENCING

Sheet numbers referenced on Parts Lists and Illustrations refers to sheet locations in this section. Example: Sheet reference 3 represents sheet 8-3, sheet 4 represents sheet 8-4, etc.

TOP-DOWN ASSEMBLY / COMPONENT PART LIST

ITEM IDENT NO	DESCRIPTION	WHERE USED	SHEET	ITEM IDENT NO	DESCRIPTION	WHERE USED	SHEET
302 75896102	TOP MECHANICAL ASM	HPC	S05	530 75774732	CLIP-PUSH IN	302 303	S05
302 75896102	TOP MECHANICAL ASM	HPC	S04	531 75774736	CLIP-PUSH IN	302 303	S05
302 75896102	TOP MECHANICAL ASM	HPC	S03	532 75889396	EJECTOR ASM	302 303	S05
303 75896103	TOP MECHANICAL ASM	HPC	S03	532 75889396	EJECTOR ASM	302 303	S12
303 75896103	TOP MECHANICAL ASM	HPC	S05	533 75883330	UPPER HARNESS ASM	302 303	S04
303 75896103	TOP MECHANICAL ASM	HPC	S04	533 REFERENCE	SEE FIGURES 2 & 7	REF	S08
303 75896103	TOP MECHANICAL ASM	HPC	S03	533 75883330	UPPER HARNESS ASM	302 303	S10
308 77650890	LATCH ASM	HPC	S03	534 09023703	SCREW	302 303	S05
309 75883185	LATCH ASM	HPC	S03	535 10127334	SCREW	302 303	S04
310 77650889	LATCH ASM	HPC	S03	536 10125605	WASHER	302 303	S05
350 75882589	DRIVE MOTOR ASM 60-120	HPC	S06	536 10125605	WASHER	302 303	S04
350 75882589	DRIVE MOTOR ASM 60-120	HPC	S03	536 10125605	WASHER	450	S08
351 75882592	DRIVE MOTOR ASM 50-220	HPC	S06	536 10125605	WASHER	533	S10
351 75882592	DRIVE MOTOR ASM 50-220	HPC	S03	536 10125605	WASHER	472	S13
352 75882591	DRIVE MOTOR ASM 60-220	HPC	S06	537 10125803	WASHER 1K	533	S10
352 75882591	DRIVE MOTOR ASM 60-220	HPC	S03	537 10125803	WASHER 1K	302 303	S04
353 75882855	DRIVE MOTOR ASM 60-120	HPC	S06	538 93592164	SCREW	450	S08
353 75882855	DRIVE MOTOR ASM 60-120	HPC	S03	538 93592164	SCREW	503	S12
354 75882858	DRIVE MOTOR ASM 50-220	HPC	S06	538 93592164	SCREW	302 303	S05
354 75882858	DRIVE MOTOR ASM 50-120	HPC	S03	538 93592164	SCREW	302 303	S04
355 75882856	DRIVE MOTOR ASM 50-120	HPC	S06	539 17901504	SCREW	302 303	S04
355 75882856	DRIVE MOTOR ASM 60-220	HPC	S03	540 75806502	WASHER	432-435	S07
356 75882857	DRIVE MOTOR ASM 60-220	HPC	S06	540 75806502	WASHER	302 303	S05
356 75882857	DRIVE MOTOR ASM 60-220	HPC	S03	541 18862916	SCREW	662 625	S10
399 77581102	CIAMSHAIL (BLACK)	HPC	S03	542 93592162	SCREW	654	S06
400 77618401	CIAMSHAIL (BLACK)	HPC	S03	542 93592162	SCREW	302 303	S05
401 75889426	CIAMSHAIL ASM	HPC	S09	542 93592162	SCREW	302 303	S04
401 75889426	CIAMSHAIL ASM	HPC	S03	542 93592162	SCREW	470	S08
402 75897401	CIAMSHAIL ASM	HPC	S09	542 93592162	SCREW	302 303	S04
402 75897401	CIAMSHAIL ASM	HPC	S03	543 94277400	CABLE TIE	684 693	S10
403 77581106	CIAMSHAIL (BROWN)	HPC	S03	543 94277400	CABLE TIE	579	S12
404 77618428	CIAMSHAIL (WHITE)	HPC	S03	543 94277400	CABLE TIE	350-356	S06
405 77618429	CIAMSHAIL (BRONZE)	HPC	S03	543 94277400	CABLE TIE	533	S10
409 77899329	FRONT PANEL	HPC	S03	544 93592202	SCREW	302 303	S04
410 75899301	FRONT PANEL (BLACK)	HPC	S03	545 10126401	WASHERS	350-356	S06
411 77631302	FRONT PANEL (BLACK)	HPC	S03	546 75731302	ELECTRICAL SYMBOL	302 303	S04
412 77631402	FRONT PANEL (BLACK)	HPC	S03	547 92012727	SCREW	302 303	S04
413 77631406	FRONT PANEL (BROWN)	HPC	S03	548 10126104	WASHER	350-356	S06
414 75889328	FRONT PANEL (WHITE)	HPC	S03	549 75738402	CAPACITOR	350 353	S06
415 75881578	SPRING	HPC	S03	549 75738402	CAPACITOR	355	S06
420 75889701	BUTTON (BLACK)	HPC	S03	551 62121108	TERMINAL	350-356	S06
421 75897201	BUTTON (BLACK)	HPC	S03	552 83435504	CONTACT	353	S06
422 75897206	BUTTON (BROWN)	HPC	S03	553 77612011	CABLE TIE	684 693	S10
423 75889728	BUTTON (WHITE)	HPC	S03	553 77612011	CABLE TIE	579	S12
424 75889729	BUTTON	HPC	S07	554 16439600	MOUNTING BRKT	350-356	S06
430 75882401	FRONT PANEL ASM	HPC	S03	555 75882341	CABLE	350-352	S06
430 75882401	FRONT PANEL ASM	HPC	S07	556 75882490	BRACKET	350-352	S06
431 75882406	FRONT PANEL ASM	HPC	S03	557 75882332	SOLENOID ASM	432	S07
432 75882405	FRONT PANEL ASM	HPC	S03	558 77636695	SOLENOID MOUNT	432	S07
432 75882405	FRONT PANEL ASM	HPC	S07	559 75738480	CAPACITOR	351 352	S06
433 75882404	FRONT PANEL ASM	HPC	S03	559 75738480	CAPACITOR	354 356	S06
434 75897950	FRONT PANEL ASM	HPC	S07	560 83435501	CONTACT	350-352	S06
434 75897950	FRONT PANEL ASM	HPC	S03	560 83435501	CONTACT	354-356	S06
435 75897951	FRONT PANEL ASM	HPC	S07	561 75726925	MOTOR	350 353	S06
435 75897951	FRONT PANEL ASM	HPC	S03	561 75726925	MOTOR	355	S06
436 75897952	FRONT PANEL ASM	HPC	S07	562 75726924	MOTOR	351 352	S06
436 75897952	FRONT PANEL ASM	HPC	S03	562 75726924	MOTOR	354 356	S06
437 75897953	FRONT PANEL ASM	HPC	S07	563 75896006	PULLEY-DUAL DR	350-356	S06
437 75897953	FRONT PANEL ASM	HPC	S03	564 83413405	SCREW	350-356	S06
440 75882037	WRITE PROTECT	HPC	S08	565 75293954	HOUSING	431-437	S07
440 75882037	WRITE PROTECT	HPC	S03	565 75293954	HOUSING	481	S08
441 75882036	DISK IN PLACE DET	HPC	S08	566 00848201	RET RING	501	S11
441 75882036	DISK IN PLACE DET	HPC	S03	566 00848201	RET RING	532	S12
450 75882185	INDEX DETECTOR KIT	HPC	S08	566 00848201	RET RING	532	S12
450 75882185	INDEX DETECTOR KIT	HPC	S03	566 00848201	RET RING	431-437	S07
460 75889979	DOOR INTERLOCK KIT	HPC	S06	567 94277400	CABLE TIE	431-433	S07
460 75889979	DOOR INTERLOCK KIT	HPC	S03	568 75882330	SOLENOID ASM	433	S07
470 75883335	KIT, TK "43"	HPC	S08	569 77632960	SOLENOID MOUNT	433-435	S07
470 75883335	KIT, TK "43"	HPC	S03	570 75888600	SHAFT LOCK	432 433	S07
471 75883336	KIT, SIDE MTG	HPC	S13	571 75882035	SPRING	432 433	S07
471 75883336	KIT, SIDE MTG	HPC	S03	572 92033147	RET RING	432 433	S07
472 75894197	KIT, BOTTOM MTG	HPC	S13	573 75882107	WASHER	432 433	S07
472 75894197	KIT, BOTTOM MTG	HPC	S03	574 94376917	SCREW	432-435	S07
499 75883128	BASE (MACHINED)	302 303	S05	575 10125801	WASHER	432-435	S07
499 75883128	BASE (MACHINED)	302 303	S04	575 10125801	WASHER	529	S11
499 REFERENCE	SEE FIGURE 2	REF	S13	576 75882335	CABLE	431-437	S07
499 REFERENCE	SEE FIGURE 2	REF	S08	577 75810701	LED	431-433	S07
501 75896122	CARRIAGE ASSEMBLY	302 303	S05	578 75810703	RET RING	431-433	S07
501 75896122	CARRIAGE ASSEMBLY	302 303	S11	579 75881932	STEPPER MOTOR ASM	503	S12
501 REFERENCE	SEE FIGURE 2 & 8	REF	S08	580 75881563	MOTOR ADAPTER	503	S12
502 75881591	SPINDLE	302 303	S04	581 75881441	PULLEY	503	S12
503 75892007	ACTUATOR ASSEMBLY	302 303	S12	582 75881785	BAND RETAINER	503	S12
503 75892007	ACTUATOR ASSEMBLY	302 303	S05	583 75882026	SCREW	503	S12
506 75888675	BAIL ASM	302 303	S04	584 75881287	CLAMP	503	S12
507 75882136	LOAD PLATE ASM	302 303	S04	585 18862716	SCREW	503	S12
507 75882136	LOAD PLATE ASM	302 303	S09	586 75883120	BAND	503	S12
508 75881326	GUIDE CARRIAGE	302 303	S05	587 75883121	BAND	503	S12
509 75881275	GUIDE ROD	302 303	S05	588 75882150	STEPPER MOTOR	579	S12
510 77616600	PULLEY-SPINDLE	302 303	S04	589 75883312	RESISTOR CABLE	579	S12
512 77616697	BEARING, FIANGED	302 303	S04	590 77612491	RESISTOR	579	S12
513 93529005	WASHER-SPRING WAVE	302 303	S04	591 93820166	SET SCREW	432	S07
515 75883017	RETAINER	302 303	S05	592 75889356	LOWER ARM ASM	501	S11
516 75888590	HINGE PIN	302 303	S04	593 75889366	UPPER ARM ASM	501	S11
517 75888591	HINGE PIN	302 303	S04	594 75883360	LOWER CARRIAGE	501	S11
518 75888595	PIN	302 303	S04	595 75880531	TOP COVER	501	S11
519 75890210	PIN, HITCH	302 303	S04	596 75888790	SPRING RETAINER	501	S11
520 75890211	PIN, HITCH	302 303	S04	597 75888785	ARM SPRING	501	S11
521 75888570	SPRING, CIAMSHAIL	302 303	S04	598 10125103	NUT	501	S11
523 75293203	BEIT-FLAT	302 303	S04	599 10127104	SCREW	501	S11
524 75883240	LATCH BLOCK	302 303	S05	600 95102700	VARNISH	501	S11
525 75882331	SOLENOID ASM	434 435	S07	600 95102700	VARNISH	503	S12
528 75883095	GUARD, HEAD CABLE	302 303	S05	601 75888650	LOAD PLATE	507	S09
529 75883215	TENSION ASSEMBLY	302 303	S05	602 75882038	FOAM	507	S09
529 75883215	TENSION ASSEMBLY	302 303	S11	603 75882348	SPRING	507	S09

TOP-DOWN ASSEMBLY/COMPONENT PART LIST

ITEM	IDENT NO	DESCRIPTION	WHERE USED	SHEET
604	75881895	CONE ASM	401 402	S09
605	75882017	COMPRESSION SPRING	401 402	S09
606	93564057	WASHER	401 402	S09
607	92033087	RET RING	401 402	S09
608	93820782	SCREW	401 402	S09
610	75881715	CONE	604	S09
611	75881892	BEARING	604	S09
612	75888607	SHAFT	604	S09
613	75888610	RETAINER	604	S09
614	75881710	SPACER	604	S09
615	75882016	COMPRESSION SPRING	604	S09
615	75882016	COMPRESSION SPRING	604	S09
616	77610637	SCREW	604	S09
616	77610637	SCREW	604	S09
617	75889295	INDEX DETECTOR ASM	450	S08
617	75889295	INDEX DETECTOR ASM	684 693	S10
618	77612981	LIGHT EMITTING DIODE	434-437	S07
619	75882145	LOWER CABLE	684 693	S10
620	77610030	DOWEL PIN	434-437	S07
621	75881365	OPTICAL SWITCH	662 625	S10
621	75881365	OPTICAL SWITCH	470	S08
622	10127311	SCREW	440 441	S08
623	75882170	UPPER CABLE	660	S10
624	10126101	LOCK WASHER	302 303	S05
625	REFERENCE	SEE FIGURE 5	REF	S08
625	77622495	"O" TRACK ASM	693	S10
626	75882327	SOLENOID	533	S10
627	10126217	SCREW	533	S10
628	93820248	SET SCREW	401 402	S09
628	93820248	SCREW	625	S10
629	77646309	"O" TRACK STOP	625	S10
630	75883180	UPPER GUIDE	660	S10
631	75720001	PHOTO SENSE	660	S10
632	92498024	TERMINAL	660	S10
633	75881825	MOUNTING-PLATE	529	S11
634	75882816	SPRING	529	S11
635	75883150	IDLER	529	S11
636	75881280	NUT PLATE	529	S11
637	75899167	SPRING	430-433	S07
638	10127102	SCREW	432-435	S07
638	10127102	SCREW	529	S11
639	75892888	DOWEL PIN	529	S11
640	93533154	ROLL PIN	529	S11
641	75882015	SPRING	529	S11
642	77646804	BUMPER	434-437	S07
643	75890856	LATCH	532	S12
644	75893550	SPRING	532	S12
646	75881575	SPRING	532	S12
647	75880751	SWITCH	460	S08
646	75889215	NUT PLATE	460	S08
649	10127169	SCREW	460	S08
650	75899166	SPRING	434-437	S07
651	75881363	OPTICAL SWITCH ASM	440	S08
652	75881364	OPTICAL SWITCH	441	S08
654	75882895	LIFTER ASM	302 303	S06
654	75882895	LIFTER ASM	302 303	S04
656	92073074	BEARING	529	S11
657	94277410	CABLE TIE	501	S11
658	75883338	BUMPER	431-433	S07
659	75893269	EJECTOR	532	S12
660	REFERENCE	SEE FIGURE 7	REF	S08
660	75883075	UPPER GUIDE ASM	533	S10
661	75888696	BRACKET	533	S10
662	75882885	"O" TRACK ASM	684	S10
662	REFERENCE	SEE FIGURE 5	REF	S08
663	75882740	COVER	654	S06
664	75882735	CYLINDER	654	S06
665	77658915	PISTON	654	S06
666	75882725	ROLLER	654	S06
667	77658910	SPRING	654	S06
668	92021009	PIN	654	S06
669	75883165	MOUNT	662 625	S10
671	75883023	CABLE	355	S06
671	75883023	CABLE	353 354	S06
672	75882890	BRACKET	355	S06
672	75882890	BRACKET	353 354	S06
677	10127105	SCREW	470	S08
678	10127167	SCREW	470	S08
679	10125102	NUT	470	S08
681	75882880	HOUSING	470	S08
682	REFERENCE	SEE FIGURE 5	REF	S11
682	75882513	FLAG	470	S08
683	REFERENCE	SEE FIGURE 5	REF	S10
683	75883196	SENSOR ASM, TK "43"	470	S08
684	REFERENCE	SEE FIGURES 2 & 7	REF	S08
684	75882177	LOWER HARNESS ASM	302	S10
684	75882177	LOWER HARNESS ASM	302	S05
685	10127122	SCREW	471	S13
686	75881607	ADAPTER	472	S13
687	75883001	ADAPTER	471	S13
688	51891120	PLUG BUTTON	302 303	S04
689	75896400	LABEL	302 303	S04
690	75897601	CABLE GUARD	302 303	S05
691	18862716	SCREW	472	S13
692	83408631	PLASTIC TUBING	501	S11
693	77641815	LOWER HARNESS ASM	303	S05
693	77641815	LOWER HARNESS ASM	303	S10

CROSS REFERENCE INDEX

ITEM IDENT NO	SHEET
399 77581102	S03
566 00848201	S07
566 00848201	S12
566 00848201	S12
566 00848201	S11
534 09023703	S05
679 10125102	S08
598 10125103	S11
536 10125605	S10
536 10125605	S13
536 10125605	S05
536 10125605	S04
536 10125605	S08
575 10125801	S11
575 10125801	S07
537 10125803	S10
537 10125803	S04
624 10126101	S05
548 10126104	S06
627 10126217	S10
545 10126401	S04
638 10127102	S07
638 10127102	S11
599 10127104	S11
677 10127105	S08
685 10127122	S13
678 10127167	S08
649 10127169	S08
622 10127311	S08
535 10127334	S04
554 16439600	S06
539 17901504	S04
691 18862716	S13
585 18862716	S12
541 18862916	S05
688 51891120	S04
551 62121108	S06
523 75293203	S04
565 75293954	S07
565 75293954	S08
631 75720001	S10
562 75726924	S06
562 75726924	S06
561 75726925	S06
561 75726925	S06
546 75731302	S04
549 75738402	S06
549 75738402	S06
559 75738480	S06
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530 75774732	S05
531 75774736	S07
540 75806502	S07
540 75806502	S08
577 75810701	S07
578 75810703	S07
595 75880531	S11
647 75880751	S08
509 75881275	S05
636 75881280	S11
584 75881287	S12
508 75881326	S05
651 75881363	S08
652 75881364	S08
621 75881365	S10
621 75881365	S08
581 75881441	S12
580 75881563	S12
646 75881575	S12
415 75881576	S03
502 75881591	S04
686 75881607	S13
614 75881710	S09
610 75881715	S09
582 75881785	S12
633 75881825	S11
611 75881892	S09
604 75881895	S09
579 75881932	S12
641 75882015	S11
615 75882016	S09
615 75882016	S09
605 75882017	S09
583 75882026	S12
571 75882035	S07
441 75882036	S03
441 75882036	S08
440 75882037	S03
440 75882037	S08
602 75882038	S09
573 75882107	S07
507 75882136	S09
507 75882136	S04
619 75882145	S10
588 75882150	S12
623 75882170	S10
684 75882177	S05
684 75882177	S10
450 75882185	S08
450 75882185	S03
626 75882327	S10
568 75882330	S07
525 75882331	S07
557 75882332	S07
576 75882335	S07

ITEM IDENT NO	SHEET
555 75882341	S06
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432 75882405	S07
431 75882406	S03
431 75882406	S07
556 75882490	S06
682 75882513	S08
350 75882589	S06
350 75882589	S03
352 75882591	S06
352 75882591	S03
351 75882592	S06
351 75882592	S03
666 75882725	S06
664 75882735	S06
663 75882740	S06
634 75882816	S11
353 75882855	S03
353 75882855	S06
355 75882856	S03
355 75882856	S06
356 75882857	S03
356 75882857	S06
354 75882858	S06
354 75882858	S03
681 75882880	S08
662 75882885	S10
672 75882890	S06
672 75882890	S06
654 75882895	S06
654 75882895	S04
687 75883001	S13
515 75883017	S05
671 75883023	S06
671 75883023	S06
660 75883075	S10
528 75883095	S05
586 75883120	S12
587 75883121	S12
499 75883128	S04
499 75883128	S05
635 75883150	S11
669 75883165	S10
630 75883180	S10
309 75883185	S03
683 75883196	S08
529 75883215	S11
529 75883215	S05
524 75883240	S05
589 75883312	S12
533 75883330	S04
533 75883330	S10
470 75883335	S08
470 75883335	S03
471 75883336	S13
471 75883336	S03
658 75883338	S07
594 75883360	S11
521 75888570	S04
516 75888590	S04
517 75888591	S04
518 75888595	S04
570 75888600	S07
612 75888607	S09
613 75888610	S09
601 75888650	S09
506 75888675	S04
661 75888696	S10
597 75888785	S11
596 75888790	S11
648 75889215	S08
617 75889295	S10
617 75889295	S08
414 75889328	S03
592 75889356	S11
593 75889356	S11
532 75889396	S05
532 75889396	S12
401 75889426	S03
401 75889426	S09
420 75889701	S03
423 75889728	S03
424 75889729	S03
460 75889979	S03
460 75889979	S08
519 75890210	S04
520 75890211	S04
643 75890856	S12
503 75892007	S12
503 75892007	S05
639 75892888	S11
659 75893269	S12
644 75893550	S12
472 75894197	S03
472 75894197	S13
563 75896006	S06

ITEM IDENT NO	SHEET
302 75896102	S04
302 75896102	S03
302 75896102	S05
303 75896103	S03
303 75896103	S05
303 75896103	S04
501 75896122	S05
501 75896122	S11
689 75896400	S04
421 75897201	S03
422 75897206	S03
402 75897401	S03
402 75897401	S09
690 75897601	S05
434 75897950	S07
434 75897950	S03
435 75897951	S07
435 75897951	S03
436 75897952	S07
436 75897952	S03
437 75897953	S07
437 75897953	S03
650 75899166	S07
637 75899167	S07
410 75899301	S03
403 77581106	S03
620 77610030	S07
616 77610637	S09
616 77610637	S09
553 77612011	S12
553 77612011	S10
590 77612491	S12
618 77612981	S07
512 77613697	S04
400 77618401	S03
404 77618428	S03
405 77618429	S03
625 77622495	S10
411 77631302	S03
412 77631402	S03
413 77631406	S03
569 77632960	S07
558 77636695	S07
693 77641815	S05
693 77641815	S10
629 77646309	S10
510 77646600	S04
642 77646804	S07
310 77650889	S03
308 77650890	S03
667 77658910	S06
665 77658915	S06
409 77899329	S03
692 83408631	S11
564 83413405	S06
560 83435501	S06
560 83435501	S06
552 83435504	S06
547 92012727	S04
668 92021009	S06
607 92033087	S09
572 92033147	S07
656 92073074	S11
632 92498024	S10
513 93529005	S04
640 93533154	S11
606 93564057	S09
542 93592162	S10
542 93592162	S04
542 93592162	S08
542 93592162	S06
542 93592162	S05
536 93592164	S12
538 93592164	S05
538 93592164	S08
538 93592164	S04
544 93592202	S06
591 93820166	S07
628 93820248	S10
628 93820248	S09
608 93820782	S09
543 94277400	S10
543 94277400	S12
543 94277400	S06
567 94277400	S07
543 94277400	S04
543 94277400	S10
657 94277410	S11
574 94376917	S07
600 95102700	S11
600 95102700	S12
684 REFERENCE	S08
662 REFERENCE	S08
682 REFERENCE	S11
533 REFERENCE	S08
660 REFERENCE	S08
501 REFERENCE	S08
499 REFERENCE	S13
499 REFERENCE	S08
625 REFERENCE	S08
683 REFERENCE	S10

WIRE PARTS

9.1 INTRODUCTION

The following paragraphs contain the following wire lists: Upper-Harness Assembly; Lower-Harness Assembly; Stepper Motor; Diskette in Place; Door-Lock-Solenoid Activity LED; Head Assemblies.

9.2 UPPER-HARNESS ASSEMBLY

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>	<u>Approximate Length, Inches</u>
Violet	S/S Index Anode	J5-6	15 (381 mm)
Gray	D/S Index Cathode	J5-4	15 (381 mm)
Brown	Contact Door Switch	J5-1	15 (381 mm)
Yellow	N/O Door Switch	J5-2	15 (381 mm)
Orange	Head-Load Solenoid+	J5-3	9 (229 mm)
Black	Head-Load Solenoid-	J5-5	9 (229 mm)
Green	Write-Protect Anode	J5-11	9 (229 mm)
Red	Write-Protect Collector	J5-12	9 (229 mm)
Blue	Write-Protect Emitter	J5-7	9 (229 mm)
White	Write-Protect Cathode	J5-8	9 (229 mm)

9.3 LOWER-HARNESS ASSEMBLY

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>	<u>Approximate Length, Inches</u>
Yellow	D/S Index Collector	J6-6	13 (330 mm)
Brown	D/S Index Emitter	J6-9	13 (330 mm)
Orange	S/S Index Collector	J6-5	13 (330 mm)
Black	S/S Index Emitter	J6-10	13 (330 mm)
Green	Anode Track 0	J6-4	9 (229 mm)
White	Cathode Track 0	J6-1	9 (229 mm)
Blue	Emitter Track 0	J6-2	9 (229 mm)
Red	Collector Track 0	J6-3	9 (229 mm)

9.4 STEPPER MOTOR

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>	<u>Approximate Length, Inches</u>
Red/White	ØA	J3-5	12 (305 mm)
Green/White	ØB	J3-8	12 (305 mm)
Red	ØD	J3-10	12 (305 mm)
Green	ØC	J3-9	12 (305 mm)
Black	Motor Com (ØA & ØD)	J3-7	12 (305 mm)
White	Motor Com (ØB & ØC)	J3-6	12 (305 mm)
Orange	+R1	J3-3	21 (533 mm)
Yellow	-R1	J3-4	21 (533 mm)
Blue	R1 (Center Tap)	J3-2	20 (508 mm)

9.5 DISKETTE IN PLACE

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>	<u>Approximate Length, Inches</u>
Green	Diskette-in-Place Anode	J8-2	15 (381 mm)
Red	Diskette-in-Place Collector	J8-4	15 (381 mm)
White	Diskette-in-Place Cathode	J8-1	15 (381 mm)
Blue	Diskette-in-Place Emitter	J8-3	15 (381 mm)

9.6 DOOR-LOCK-SOLENOID ACTIVITY LED

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>	<u>Approximate Length, Inches</u>
Red	Door-Lock Solenoid+	J7-1	9 (229 mm)
Black	Door-Lock Solenoid-	J7-4	9 (229 mm)
Brown	Activity LED Anode	J7-2	9 (229 mm)
Blue	Activity LED Cathode	J7-3	9 (229 mm)

9.7 HEAD ASSEMBLIES

HEAD 0

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>
Black	Read/Write	J2-1
White	Read/Write	J2-2
White (large wire)	Shield	J2-3
Green	Erase+	J2-4
Red	Center Tap	J2-5
-	Key	J2-6
Yellow	Erase-	J2-7

HEAD 1

<u>Wire Color</u>	<u>Origin</u>	<u>Destination</u>
Black	Read/Write	J2-8
White	Read/Write	J2-9
Red	Center Tap	J2-10
Green	Erase+	J2-11
White (large wire)	Shield	J2-12
-	Key	J2-13
Yellow	Erase-	J2-14

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